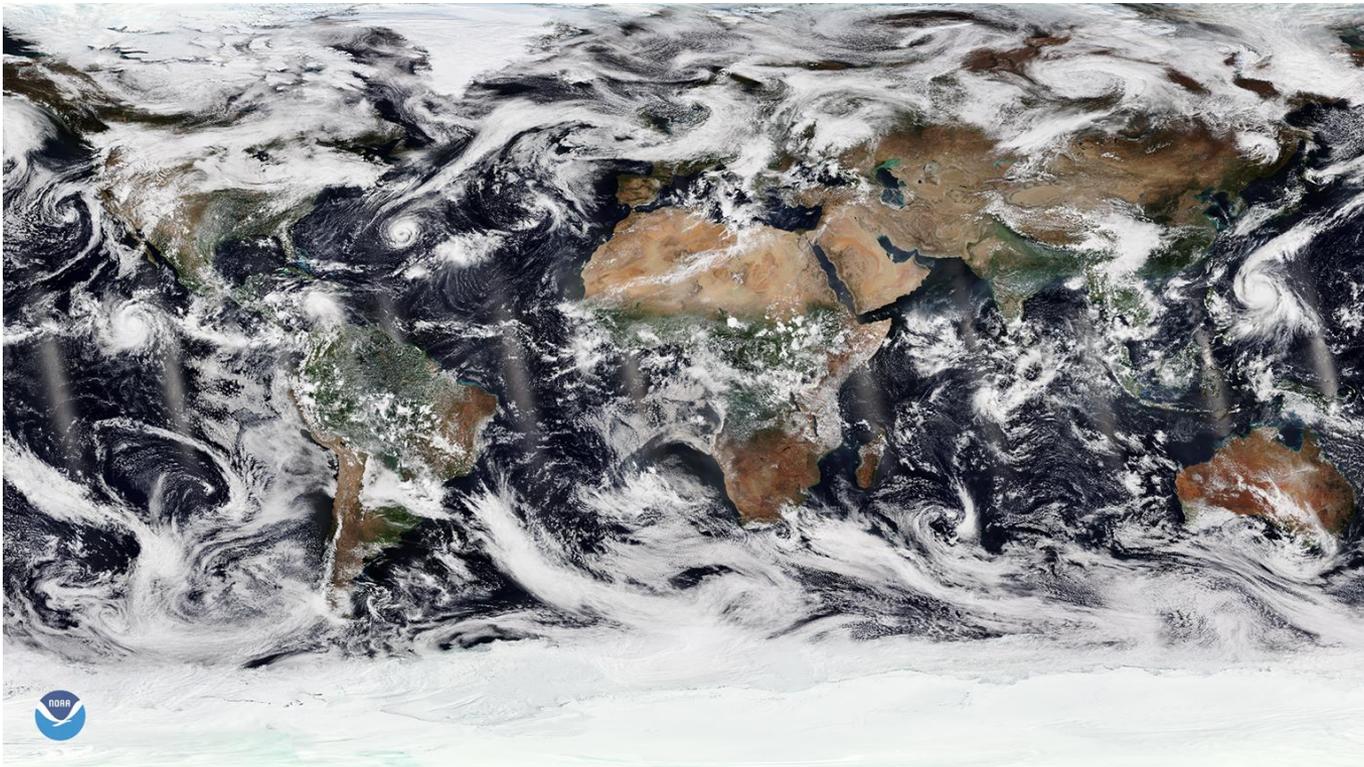




An Introduction to the

National Environmental Satellite, Data, and Information Service

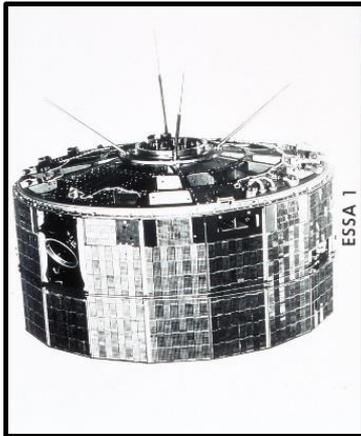


Dr. Stephen Volz, Assistant Administrator
February 12, 2019

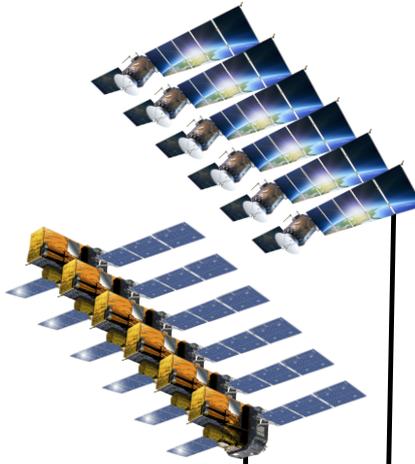
Satellite Observations since 1958



Explorer-1



ESSA-1



NOAA-2-19

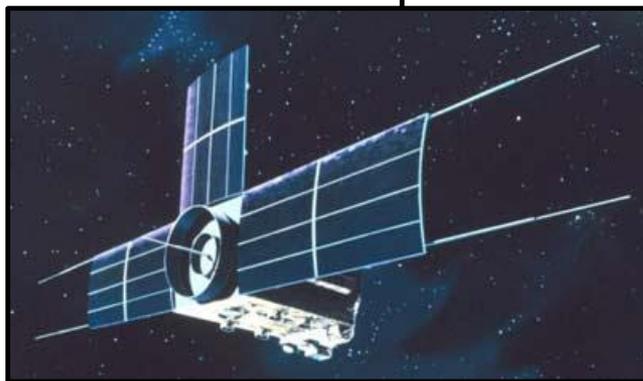


GOES-1-15

GOES-16



TIROS-1



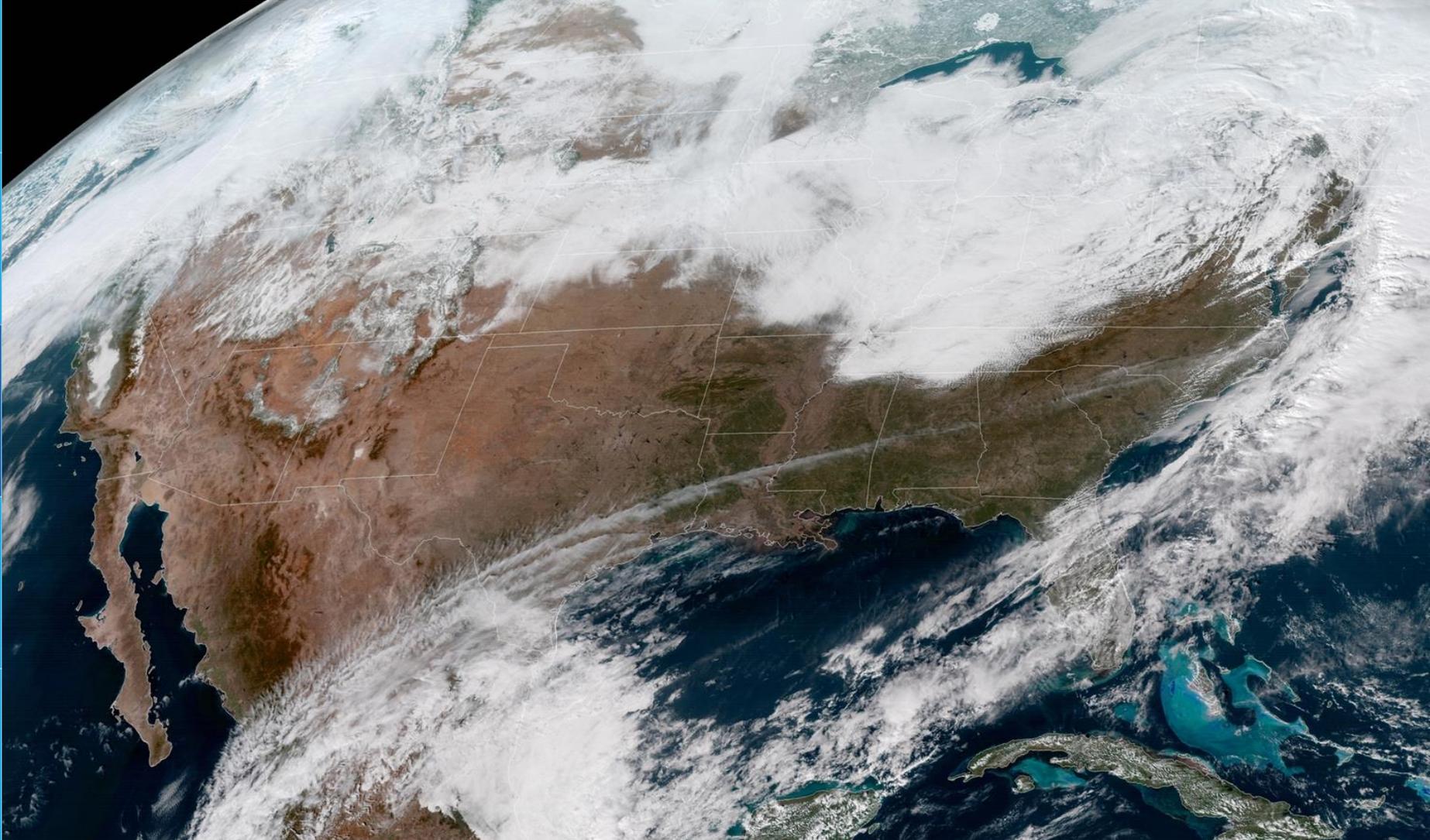
NOAA-1



NOAA-20



We are a trusted source of environmental information for the United States . . .





... with a global perspective



09 Sep 2018 16:15 UTC GOES-East GEOCOLOR

Vision:

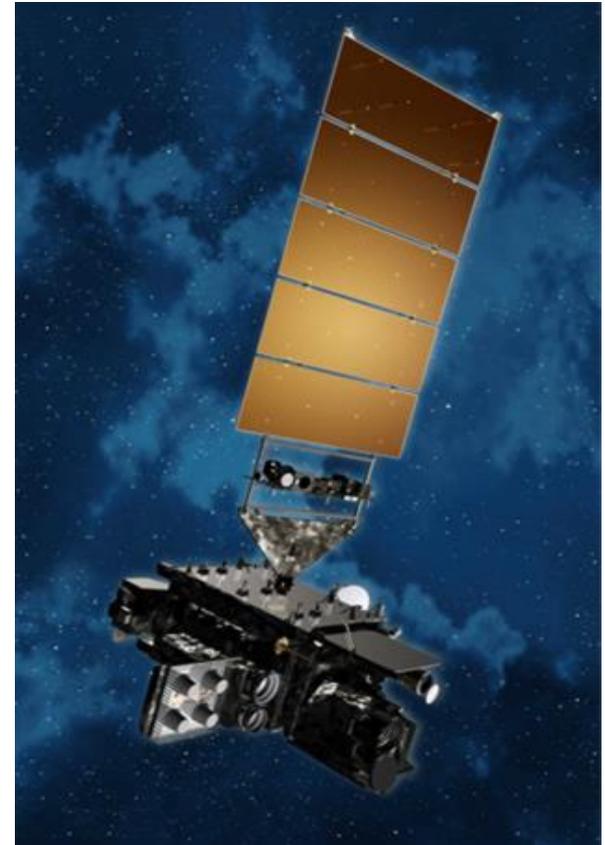
Expand understanding of our dynamic planet as the trusted source of environmental data



NESDIS's Mission is Essential to National Security, Safety, and Prosperity



- Operates the Nation's weather satellites, 24/7
- Acquires next-generation Earth observation satellites
- Provides data and imagery for predictive environmental and atmospheric modeling
- Provides definitive assessments of the U.S. and global climate
- Maintains one of the most significant archives of environmental data on Earth



**95% of the data used in weather forecast models
come from satellites**



NOAA Operates 18 Satellites



- USA
- JAPAN
- SOUTH KOREA
- CHINA
- FRANCE
- RUSSIA
- NOAA
- EUMETSAT
- EUROPEAN COMMISSION
- NATIONAL SPACE ORGANIZATION (NSPO)
- EUROPEAN SPACE AGENCY
- NASA
- DEPARTMENT OF DEFENSE



- GEOSTATIONARY ORBIT
- NEAR-POLAR ORBIT
- LAGRANGE POINT 1



International Partnerships are an Essential Part of NOAA's Observing System





NESDIS Flight Roll-Out Chart



JASON-3

OPERATIONAL JULY 1, 2016

DSCOVR

OPERATIONAL JULY 27, 2016

COSMIC-2

COSMIC-2A - 2019

GOES-R SERIES

GOES-16 - OPERATIONAL DEC 18, 2017
GOES-17 - LAUNCHED March 1, 2018
GOES-T - TBD
GOES-U - FY 2025

JPSS SERIES

NOAA-20 - OPERATIONAL MAY 30, 2018
JPSS-2 - FY 2023
JPSS-3 - FY 2026
JPSS-4 - FY 2031

NASA

Raytheon	LASP
Harris	UCAR
Ball Aerospace	Assurance Tech
ERT	ULA
Orbital-ATK	Space X



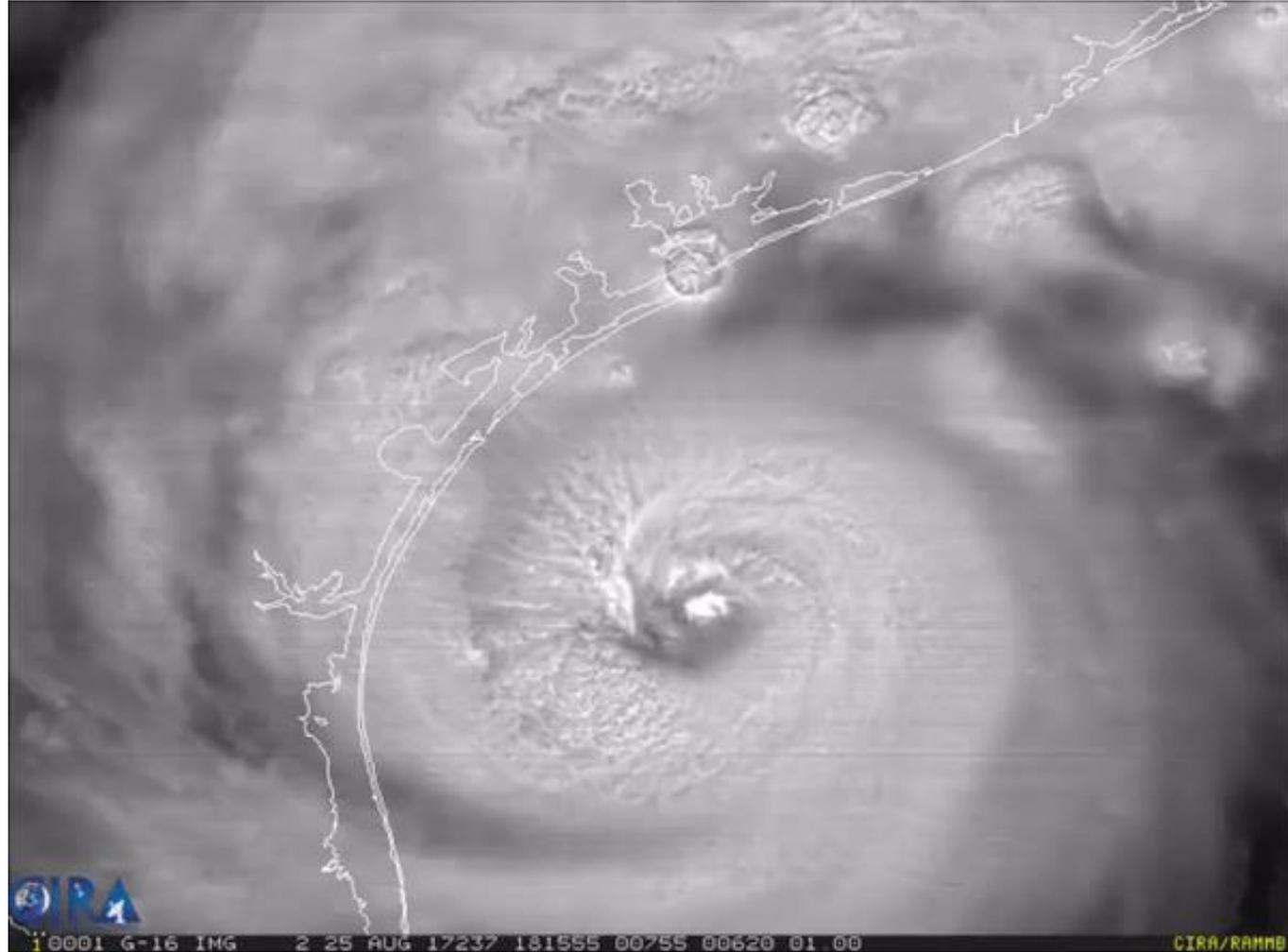


High-resolution imagery is vital for emergency management

**Hurricane Harvey,
August 2017:**

GOES-16's high resolution imagery allows precise tracking of a hurricane's eye.

Emergency officials pinpointed windows of opportunity for evacuation as the storm made landfall in southeast Texas.

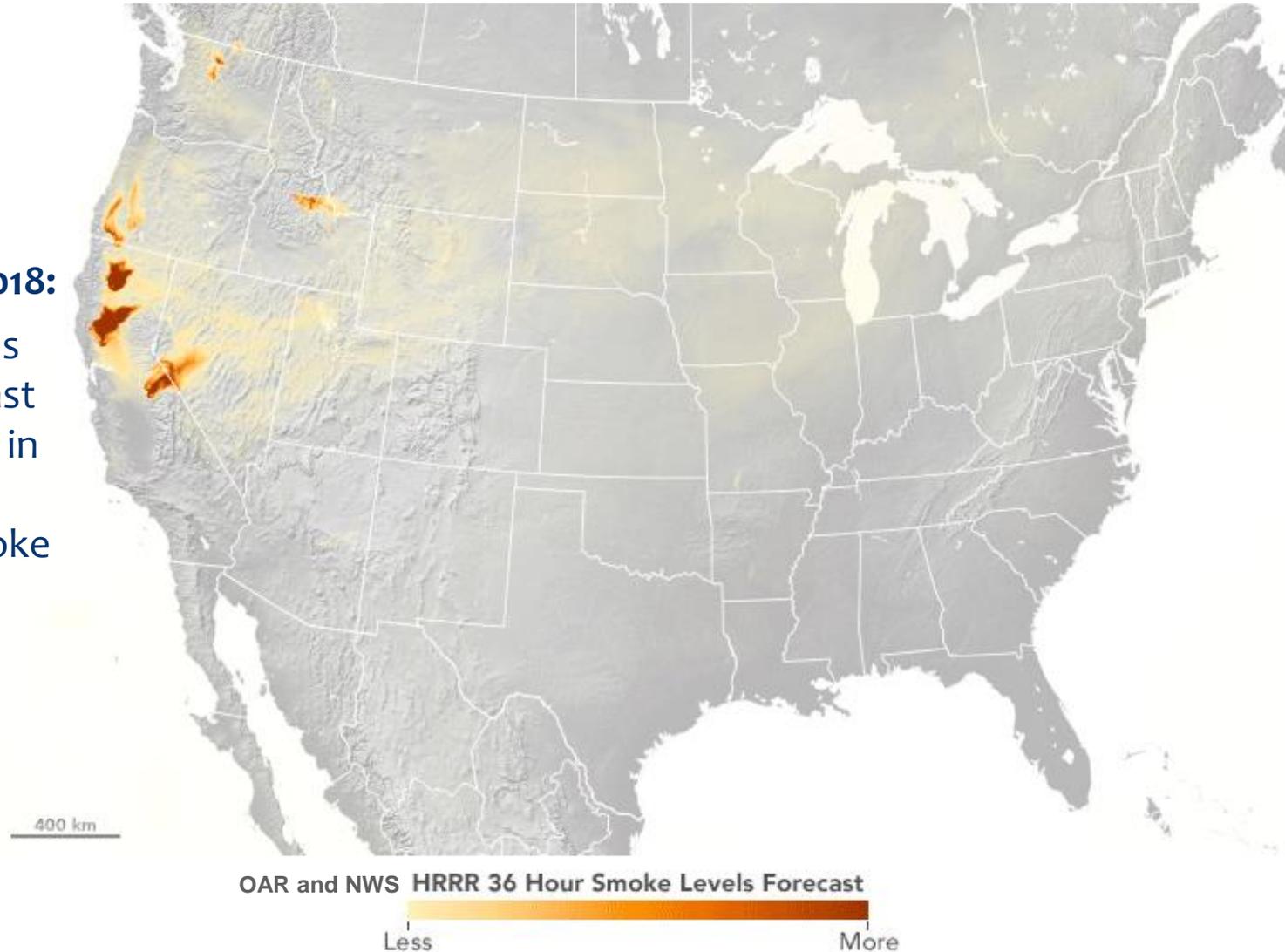




Data-driven models help track threats

Carr Fire, July 2018:

Amtrak suspends part of their Coast Starlight service in light of detailed forecasts of smoke movement.

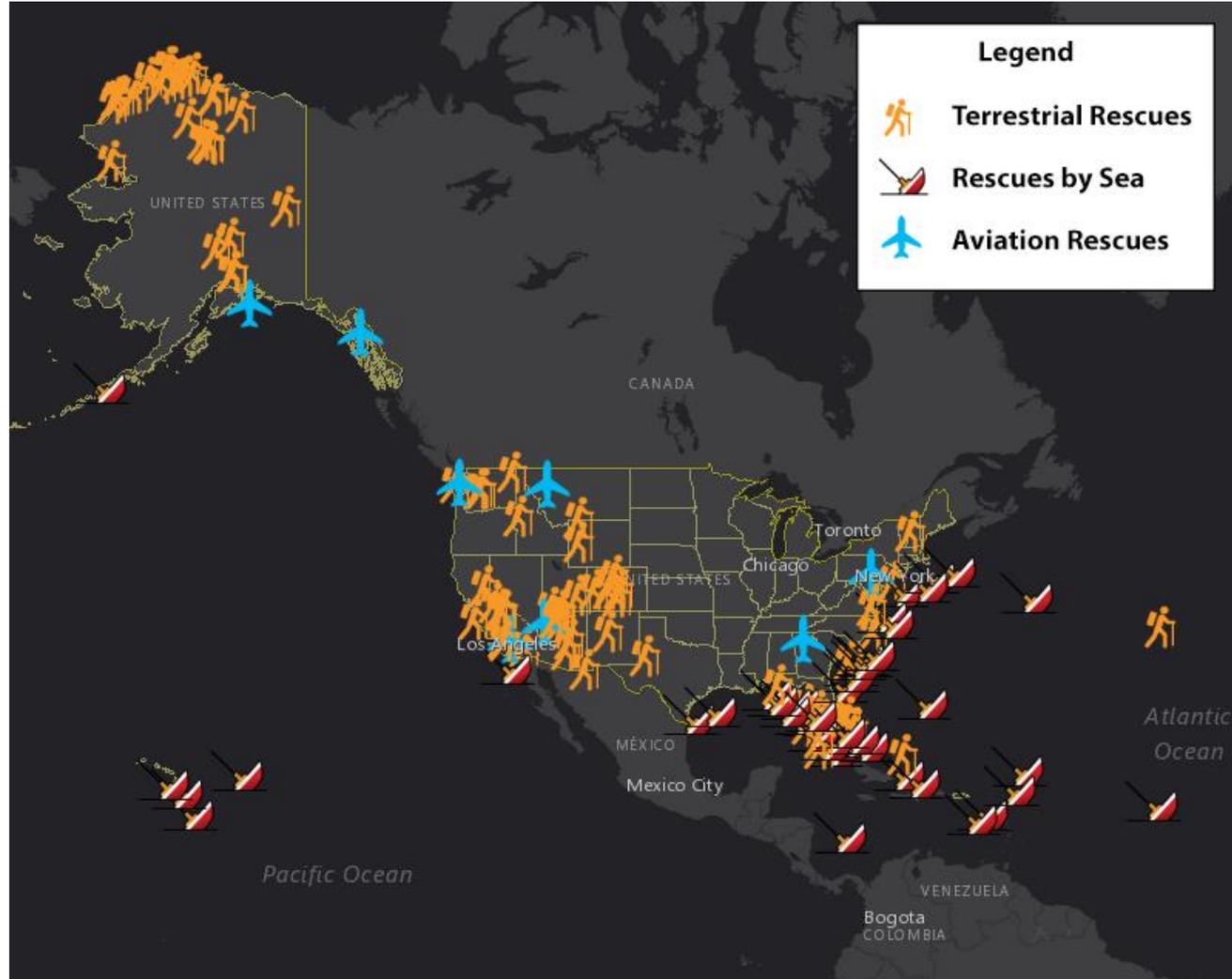


SARSAT takes the “search” out of search and rescue



Uses NOAA geostationary, polar-orbiting, and GPS satellites to locate mariners, aviators, and recreational enthusiasts in distress, almost anywhere in the world, at anytime, and in almost any condition

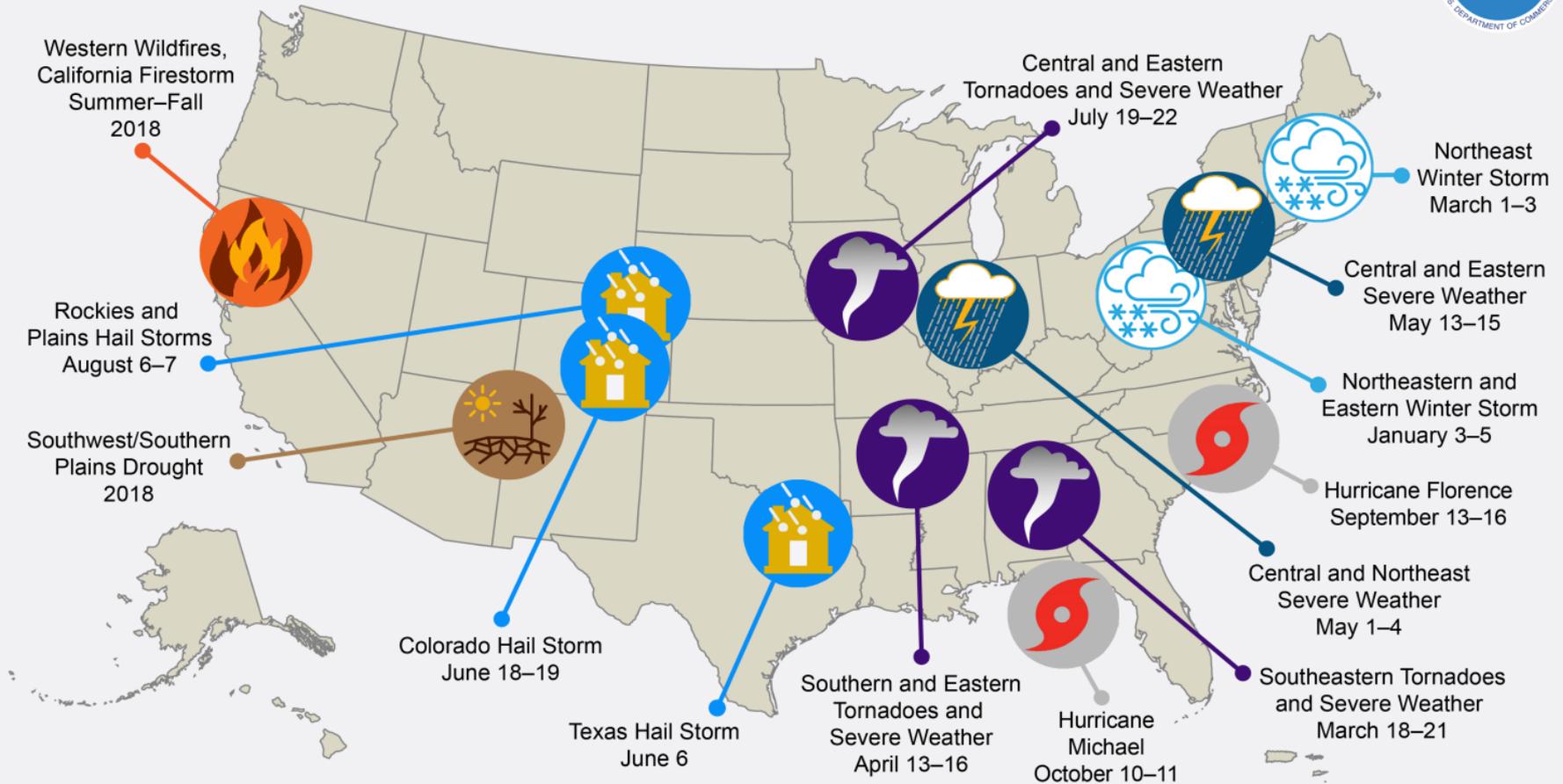
Over 43,000+ people rescued worldwide since 1982





We reveal the economic impacts of weather and climate . . .

U.S. 2018 Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the 14 separate billion-dollar weather and climate disasters that impacted the United States during 2018.
<https://www.climate.gov/news-features/blogs/beyond-data/2018s-billion-dollar-disasters-context>





... And help to mitigate them

San Francisco International Airport, a single morning in March 2017:

Forecasters used GOES-16 imagery to predict when the fog would start to lift.

>32 flights freed up

>20 hours of flight delays prevented

>\$100,000 saved



Photo taken by: Brian Burger

Anchorage, January 30, 2019

“I wanted to pass up an ‘operational thanks.’ In my nearly 6 years forecasting here, I have never seen a product revolutionize our ability to forecast the way GOES-17 has. So often up here in AK, we are “flying blind.” ... The advent of GOES over our domain makes forecasting tangibly easier and better. The other night, I was forecasting fog over SW Alaska. In the past, you have to wait for a VIRS pass and *hope* it covers your area of interest... Now, not only do I have reliable data, but I can *loop* that data. This changes everything.”

-- Anchorage Alaska Weather Forecast Office



Earth Information is Increasingly Critical to Thriving on our Planet

- **Helping Plan our Day**

300 billion weather forecasts are used by Americans every year.

- **Protecting Our Health**

- **Keeping Us Secure**

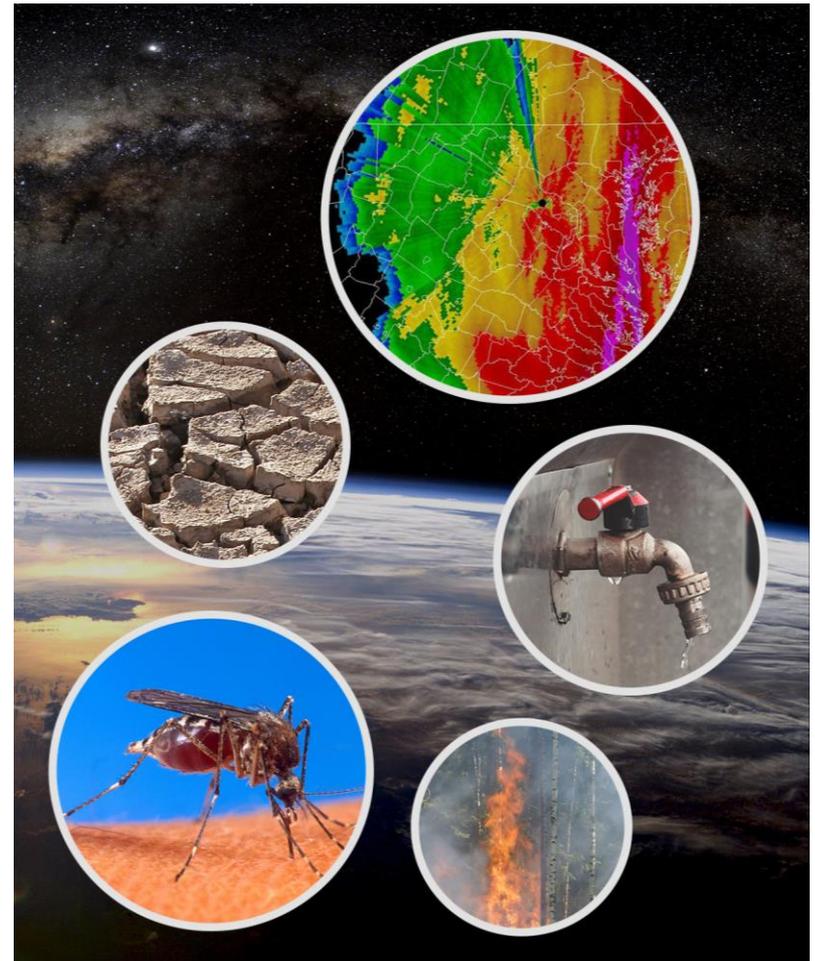
\$2 billion dollars per year is the estimated value of NASA and NOAA information services to the U.S. Navy's operational effectiveness.

- **Mitigating Natural Disasters**

- **Ensuring Resource Availability**

Extreme weather and fires have cost the federal government more than \$350 billion.

--National Academy of Science 2018 Decadal Survey

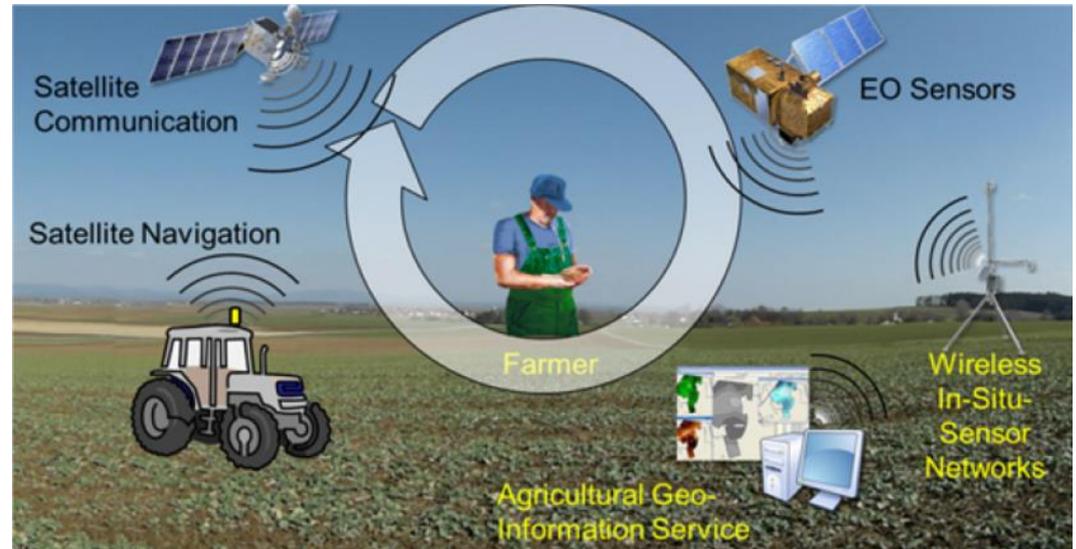


Earth Observation Information Fuels American Enterprise



Industry depends on NESDIS data to support business decisions

- Agriculture
- Shipping
- Energy
- Law
- Insurance
- Transportation
- Entrepreneurs
- Many more...





Three Observation Viewpoints



Polar Satellites

Each satellite covers the Earth twice per day

- Pole-to-pole orbit is 102 minutes and views each location at the same time of day
- Global coverage every 12 hours with one satellite
- DOD in the early morning orbit; EUMETSAT in the mid-morning orbit; NOAA in the early afternoon orbit

Geostationary Satellites

Continuous monitoring of the Western Hemisphere

- Same geographic image over time
- Usable images between 60°N and 60°S
- Extremely low latency, ~5 min
- GOES-East and GOES-West for full Western Hemisphere coverage

Deep Space Satellites

Continuous monitoring of the surface of the Sun

- Located ~1 million miles from Earth, at the Lagrange Point 1 position of the Sun-Earth system
- Uninterrupted view of the sun
- Real-time solar wind monitoring. Provides 15 – 60 minutes warning time

Long-range Forecasting Requires Global Observations from Polar-Orbiting Satellites



NOAA-20 Instruments

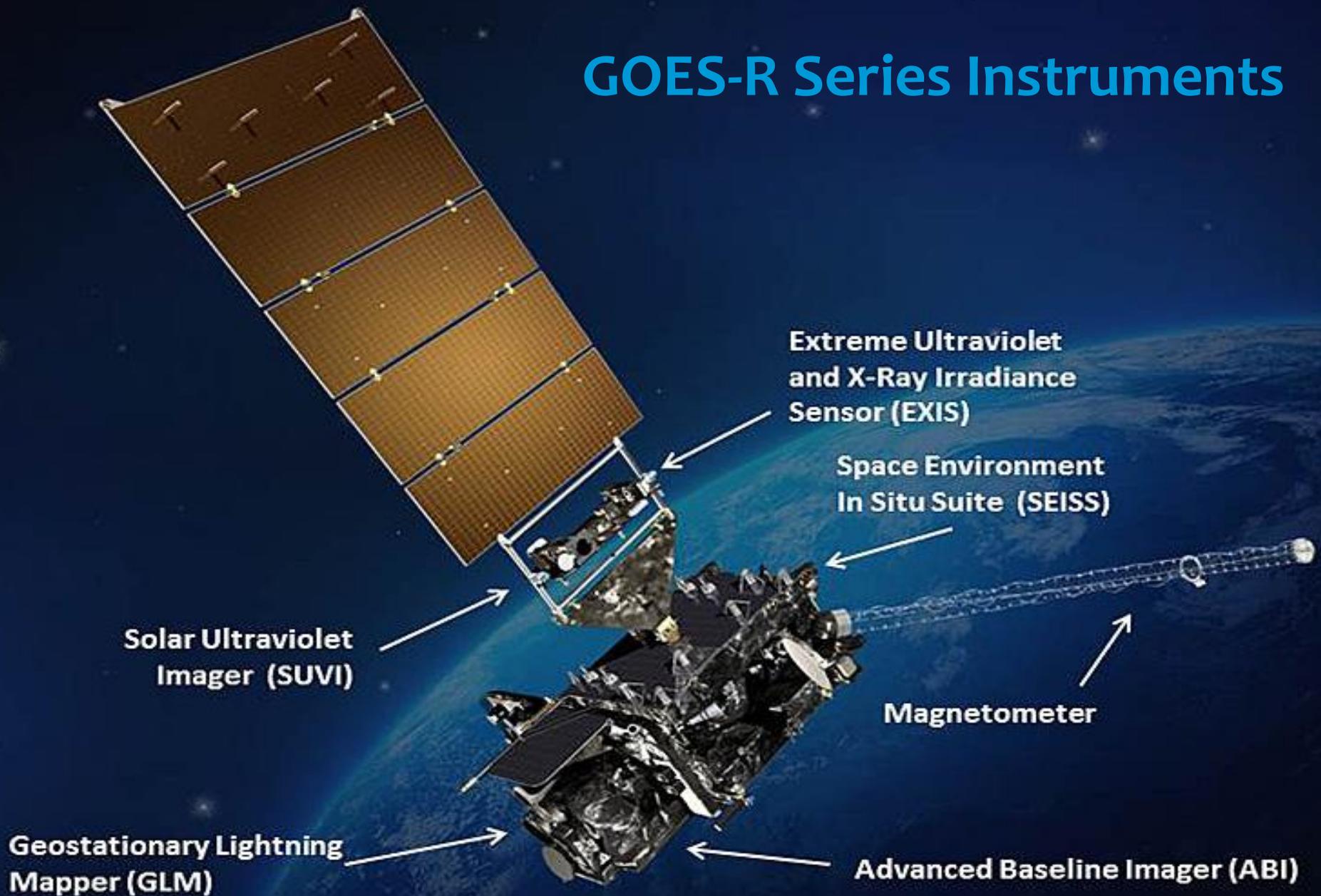




GOES satellites provide continuous coverage of the Western Hemisphere



GOES-R Series Instruments



Solar Ultraviolet Imager (SUVI)

Extreme Ultraviolet and X-Ray Irradiance Sensor (EXIS)

Space Environment In Situ Suite (SEISS)

Magnetometer

Geostationary Lightning Mapper (GLM)

Advanced Baseline Imager (ABI)



We've delivered on our Commitments

15 Months and 3 Successful Launches



Coming Soon:
COSMIC-2 Launch in 2019



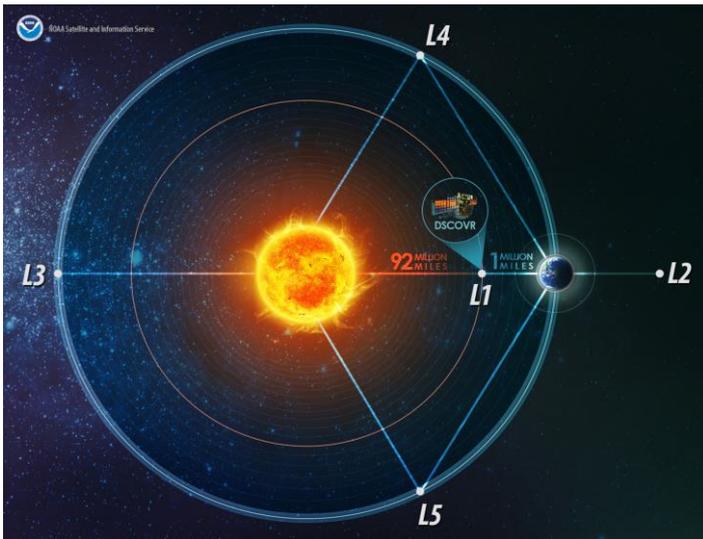


NOAA's Space Weather Mission

- **“Space weather” is a broad term used to describe electromagnetic energy and particles from the sun that blow toward Earth**
- **Space weather events like geomagnetic storms caused by changes in solar wind have the potential to disrupt nearly every major public infrastructure system, including power grids, telecommunications, aviation and GPS.**

DSCOVR (Deep Space Climate Observatory)

- Provides real-time solar wind monitoring
- Critical to the accuracy and lead time of NOAA's space weather alerts and forecasts
- Monitors the earth approximately 1 million miles away, located at Lagrange point 1 (L1)
- Launched in 2015



Space Weather Follow On (SWFO-L1)

Will complement and extend measurements from DSCOVR

- A key instrument on SWFO-L1 is a compact coronagraph (CCOR), being developed by the Naval Research Laboratory (NRL)
- CCOR will be used for:
 - Collecting coronal mass ejection (CME) data, which is currently only collected by NASA's SOHO satellite (launched in 1995)



A Paradigm and a Challenge

From the 2017 National Academies Decadal Survey

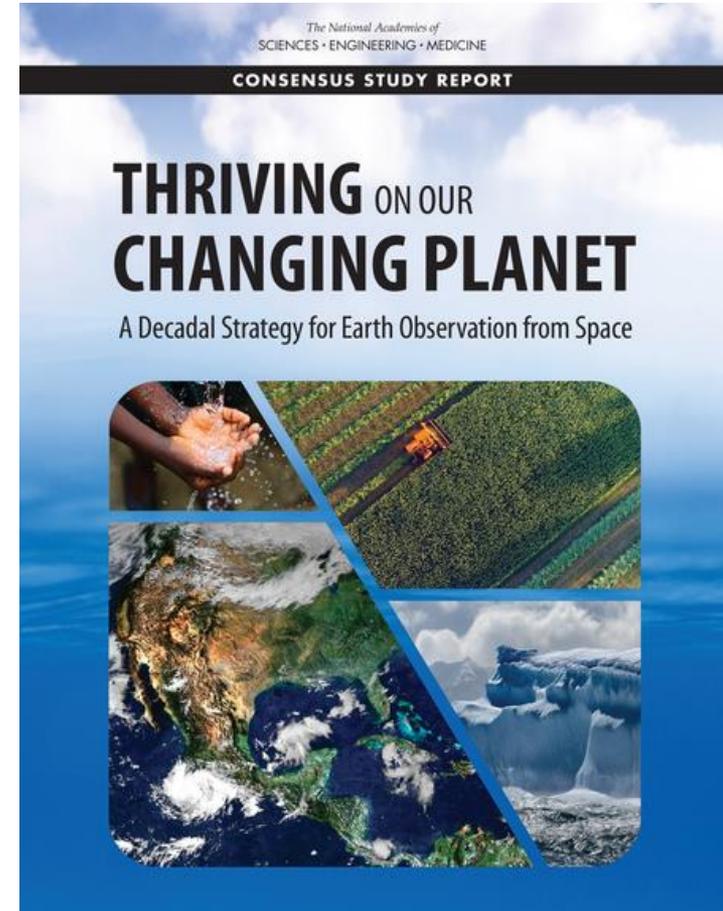


Earth Science and Applications Paradigm for the Coming Decade

Earth science and derived Earth information have become an integral component of our daily lives, our business successes, and society's capacity to thrive. Extending this societal progress requires that we focus on understanding and reliably predicting the many ways our planet is changing.

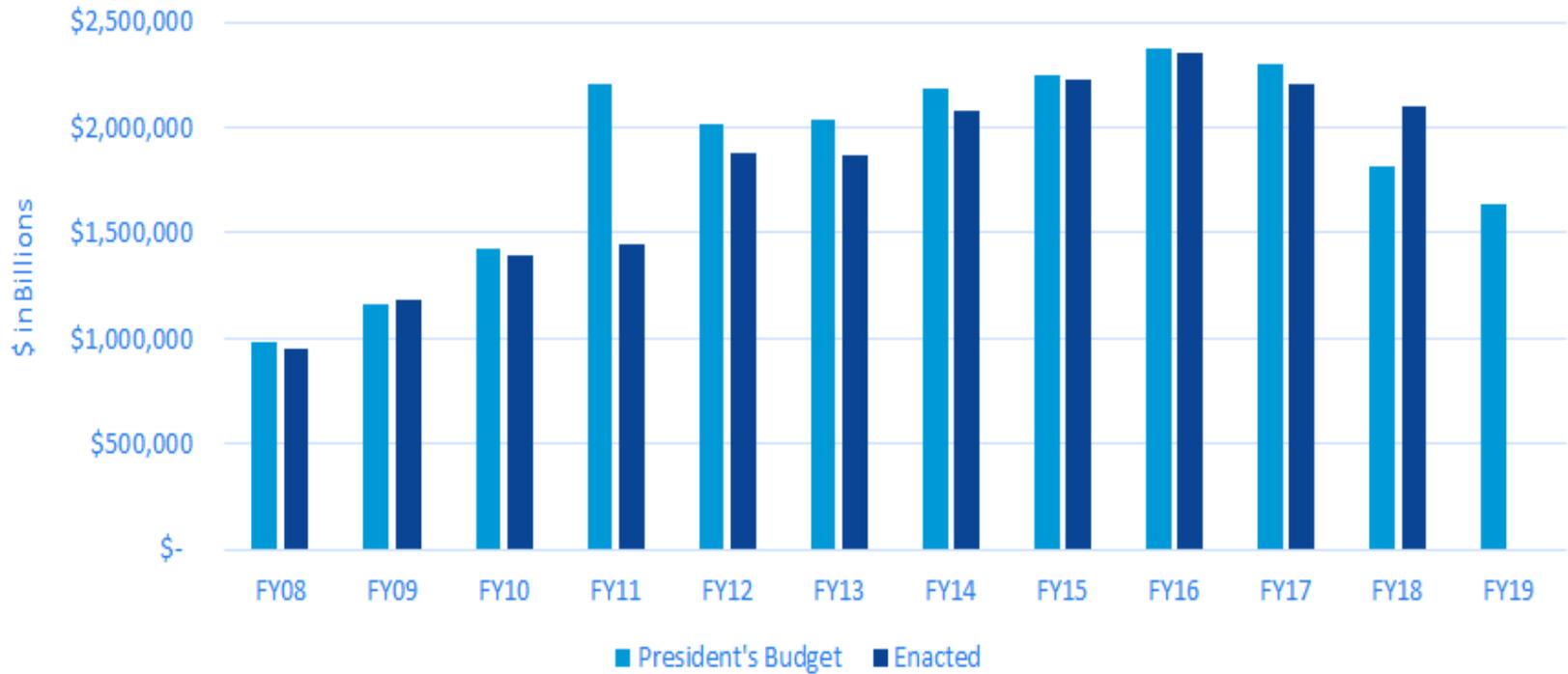
Decadal Community Challenge

Pursue increasingly ambitious objectives and innovative solutions that enhance and accelerate the science/applications value of space-based Earth observation and analysis to the nation and to the world in a way that delivers great value, even when resources are constrained, and ensures that further investment will pay substantial dividends.



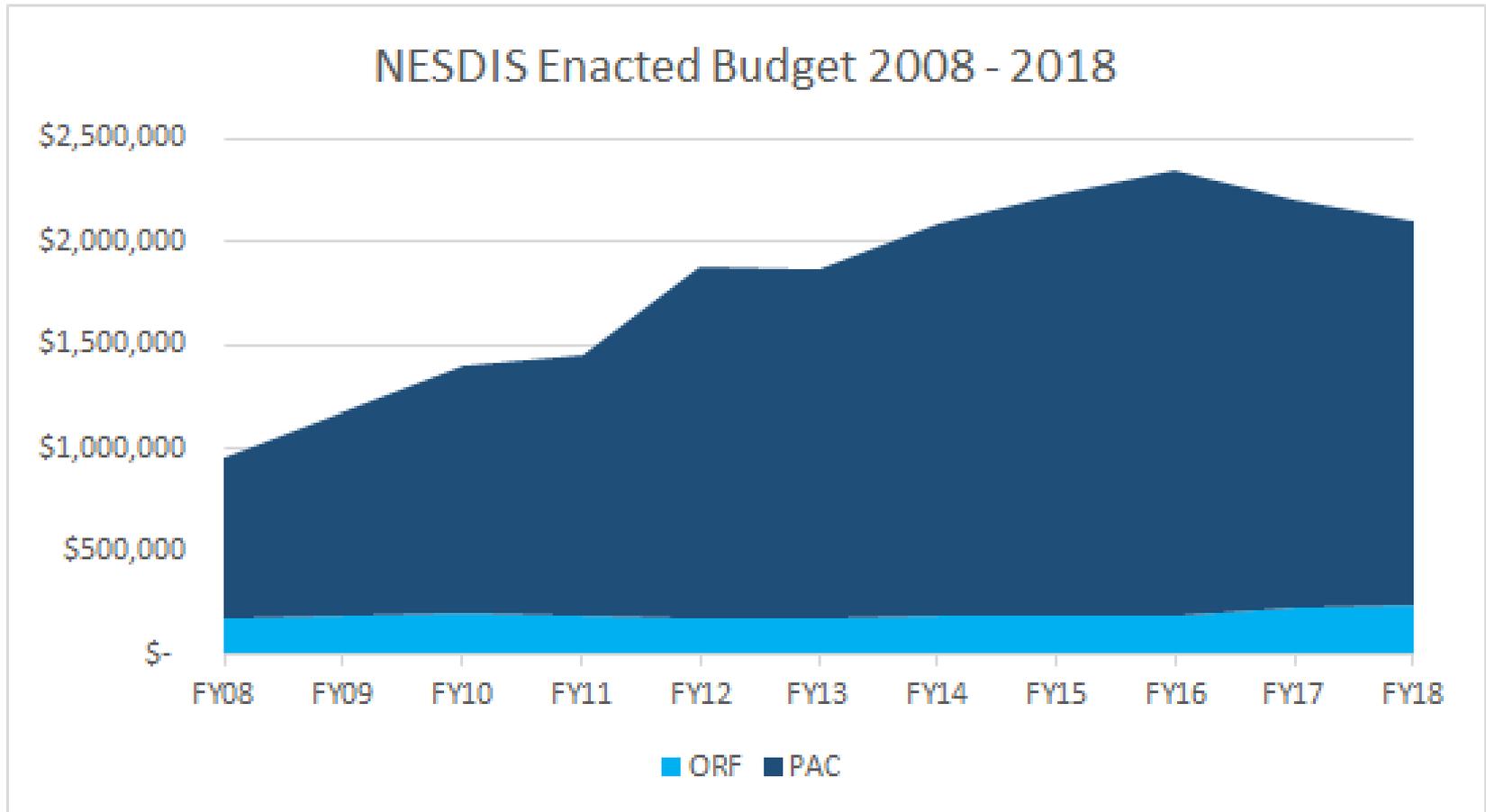


NESDIS Budget Trends





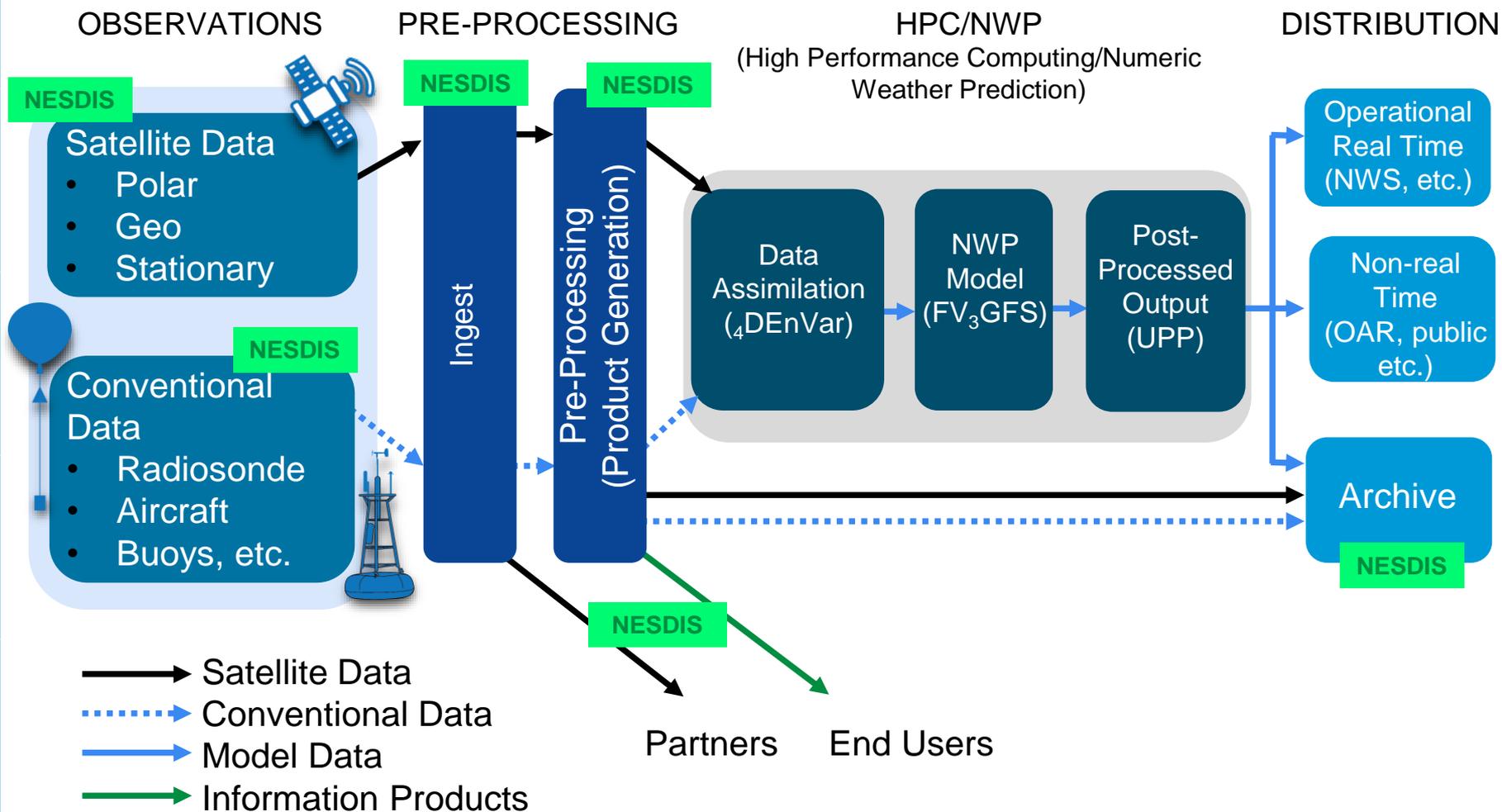
NESDIS Budget Trends



NESDIS BUDGET (§ IN THOUSANDS)

	PPA	FY18 Enacted	FY19 Conference Mark
ORF	Satellite and Product Operations (OSPO)	131,480	132,144
	Facility Operations	14,250	14,780
	Product Development, Readiness & Applications (PDR&A)	31,000	31,000
	Commercial Remote Sensing Regulatory Affairs (CRSRA)	1,800	1,800
	Office of Space Commerce (OSC)	1,200	1,800
	National Centers for Environmental Information (NCEI)	60,642	60,642
	Group on Earth Observations (GEO)	500	500
	TOTAL ORF	240,872	242,666
PAC	Joint Polar Satellite System (JPSS)	775,777	548,035
	Polar Follow On (PFO)	419,000	329,956
	Cooperative Data and Rescue Services (CDARS)	21,650	26,539
	COSMIC-2/GNSS RO	6,100	5,892
	Geostationary Systems – R (GOES-R)	518,532	408,380
	Space Weather Follow On (SWFO)	8,545	27,000
	Satellite Ground Services (SGS)	57,325	58,000
	Programs, Planning & Analysis (OPPA)	39,391	40,000
	System Architecture & Advanced Planning (OSAAP)	4,929	4,929
	Commercial Weather Data Pilot (CWDP)	6,000	6,000
	Satellite CDA Facility	2,450	2,450
	Transfer to OIG	-1,302	-1,302
Total PAC	1,858,397	1,455,879	
NESDIS TOTAL		2,099,269	1,698,545

End-to-End Product and Data Management – Synergies Across NOAA



New Capabilities Possible and Under Consideration



LEO

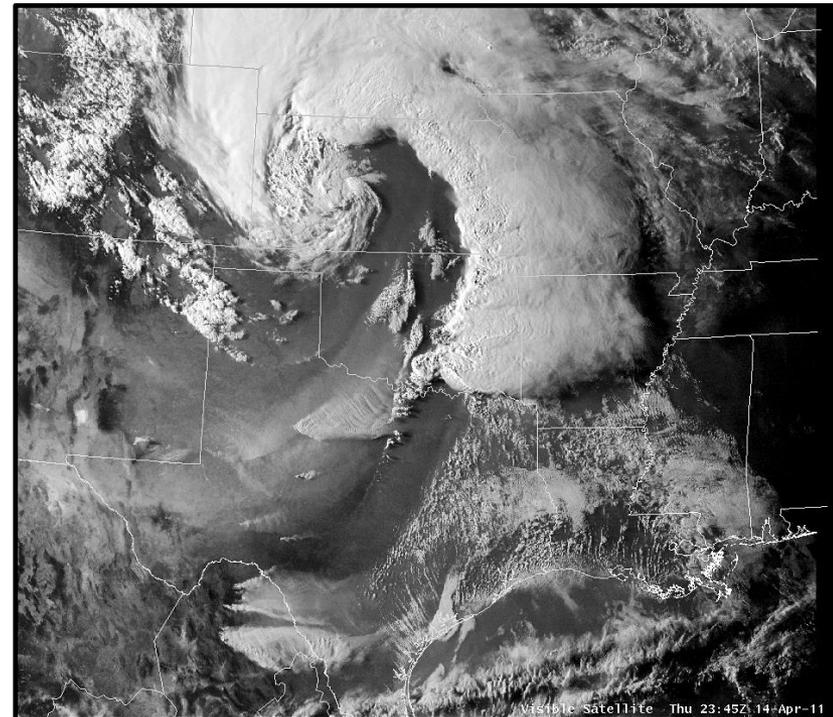
- Next generation & additional sounders
- Much higher density GNSS-RO
- Precipitation & wind measurements
- Mixed update/rate/data quality vertical sounding data set

GEO

- Diverse quality imaging from three locations (east, west, center)
- Includes mixture of qualities, taskable update rates, and spectrum content
- Higher quality lightning mapper in center

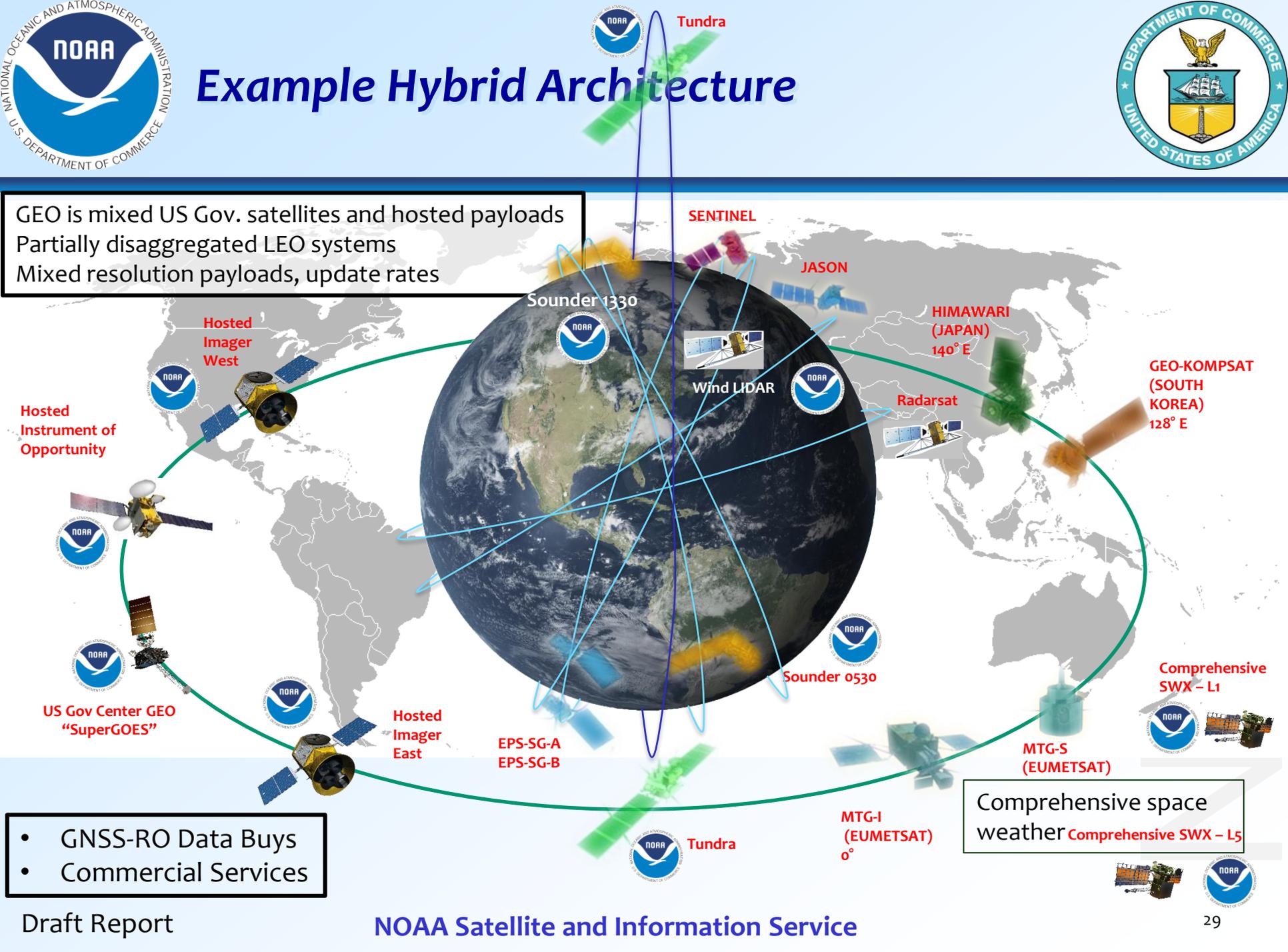
Space Weather

- Operational and improved on-Earth-Sun-Axis solar observation
- Off-axis solar observation and situ space weather



Example Hybrid Architecture

GEO is mixed US Gov. satellites and hosted payloads
 Partially disaggregated LEO systems
 Mixed resolution payloads, update rates



- GNSS-RO Data Buys
- Commercial Services

Comprehensive space weather Comprehensive SWX - L5



Hot Issues for NESDIS



- Defining and financing the next generation satellite observing system



- Maintaining and growing commercial and international partnerships to deliver a resilient and high-performing observing system



- Exploiting IT advances in data analytics, and efficient movement to the cloud



- Incorporating AI into weather forecasts and data products

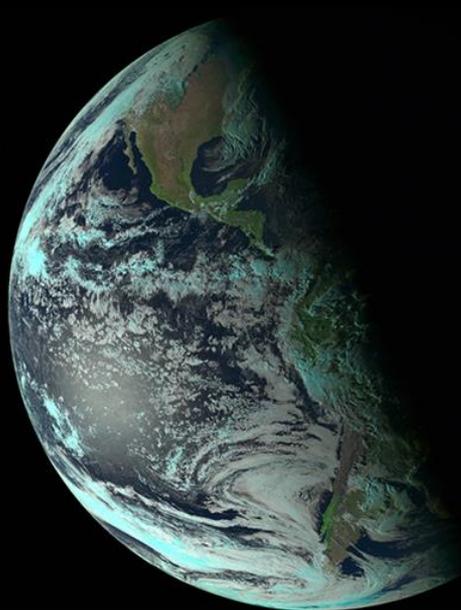




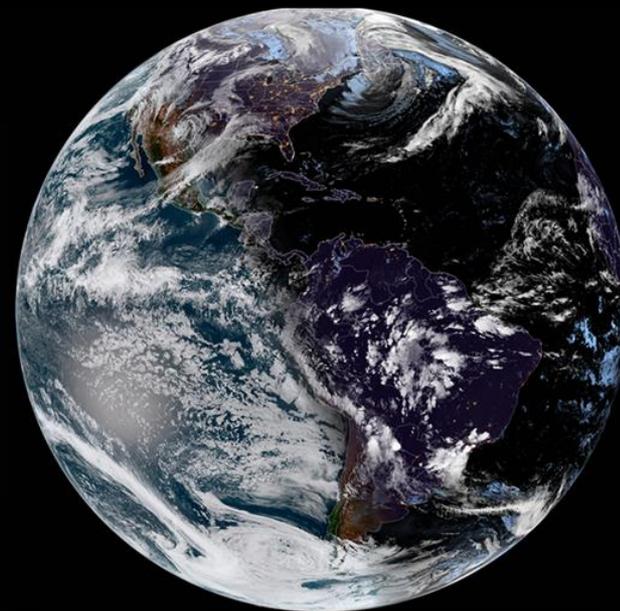
Backup Slides



Band 2—Visible



Natural Color



GeoColor

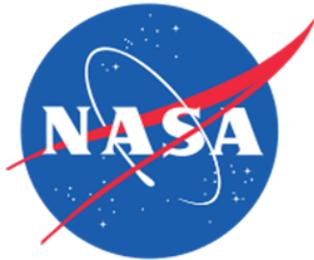
These three images from NOAA's GOES East (GOES-16) satellite show us what Earth looks like from space near the solstice. The images were captured about 24 hours before this year's solstice, at 5:30 p.m. on Dec. 20, 2018.



NOAA's Role in National Space Policy

Civil Space Sector

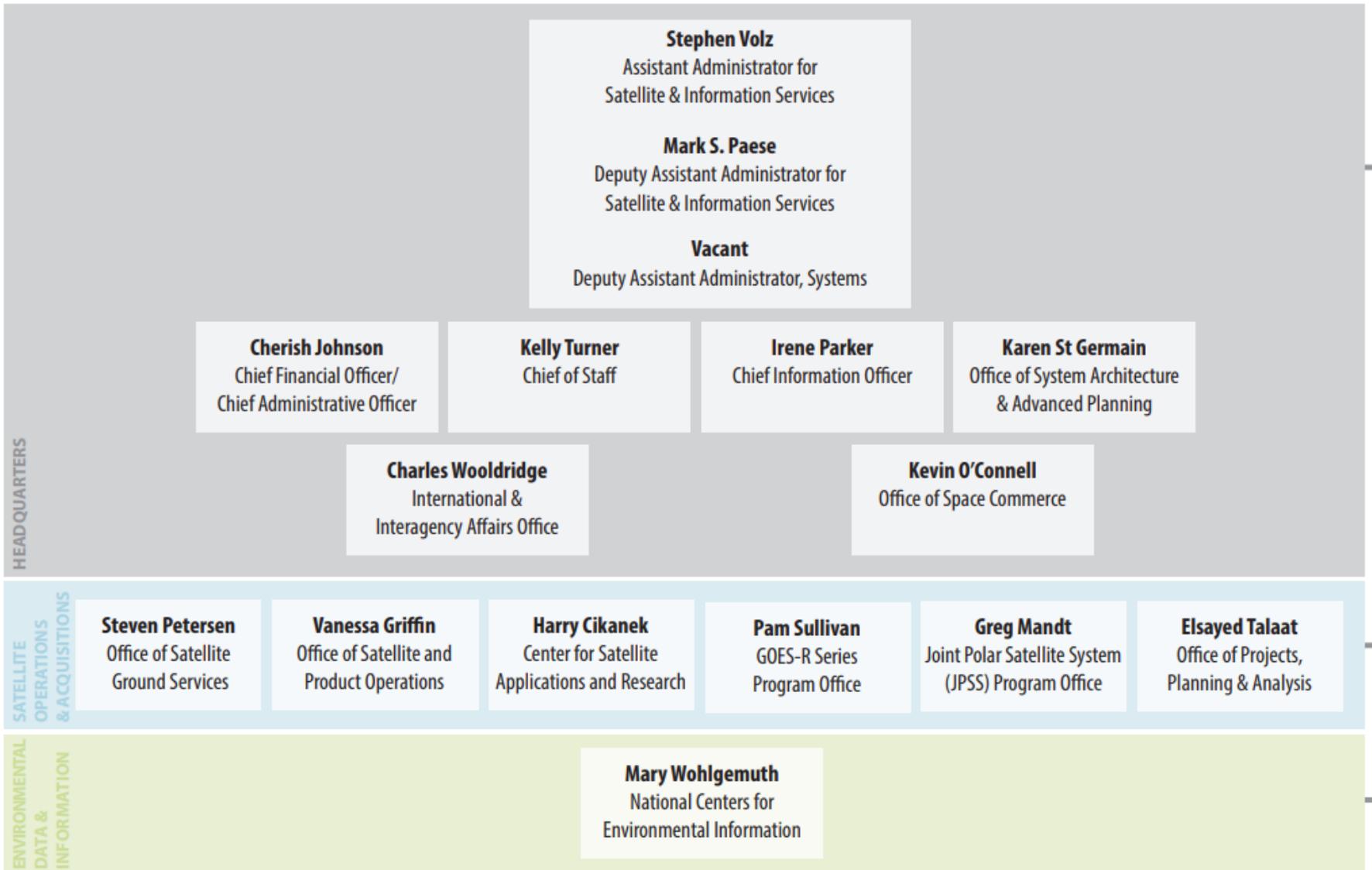
Defense Space Sector



Focus on Earth system research	Focus on weather and space weather observations and applications	Focus on land remote observations and land use applications	Focus on intelligence gathering and weather and environmental applications to support military operations
Usually no more than one satellite per new research area. No backup satellites and less demanding reliability requirements	Operational, continuous missions. 2-4 satellites per block purchase, spares on ground or in space	Operational, continuous missions - utilizing capabilities provided by NASA (Landsat series)	Operational, continuous missions - block purchase of satellites, spares on ground or in space
Large, changing array of research observations dictated by national research priorities	Core set of observational requirements, with requirements increasing in response to operational needs		Core set of observational requirements, increasing in response to operational needs
Partners with both NOAA and USGS to leverage satellite building expertise	History of relying on NASA for space segment development		Independent space and ground segment development capability

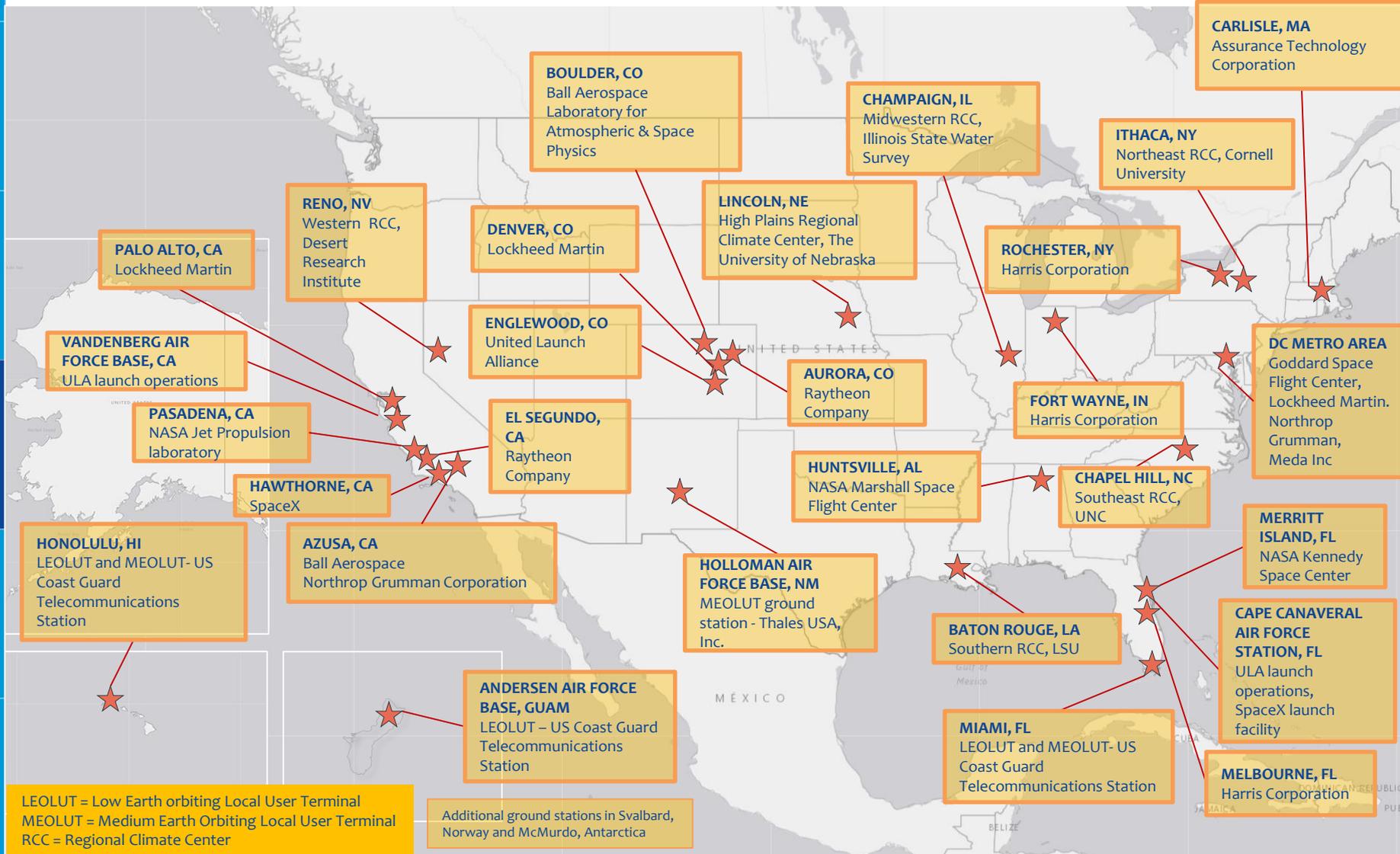


NOAA Satellite and Information Service Organizational Chart





NESDIS Partners and Contracts



Overview: Polar Orbiting Weather Satellites



NESDIS relies on data from 3 distinct polar-orbiting weather satellite families

1. Joint Polar Satellite System (JPSS)
 - a. NOAA-NASA Suomi NPP
 - b. NOAA-20 (JPSS-1)
 - c. Coming up: JPSS-2 and Polar Follow On (PFO) Satellites JPSS-3 and JPSS-4
2. Legacy Satellites: Polar-orbiting Operational Environmental Satellites (POES)
 - a. NOAA-15, -18, -19. Operating beyond design life.
 - b. Metop-A, -B, -C
3. Legacy Satellites: Defense Meteorological Satellite Program (DMSP) for the U.S. Air Force
 - a. Operating beyond design life

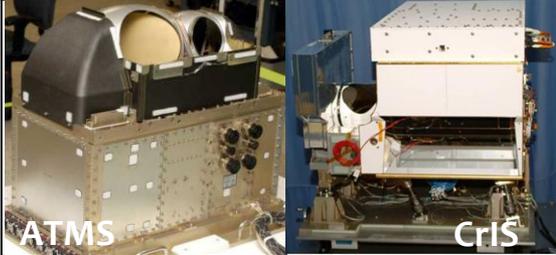
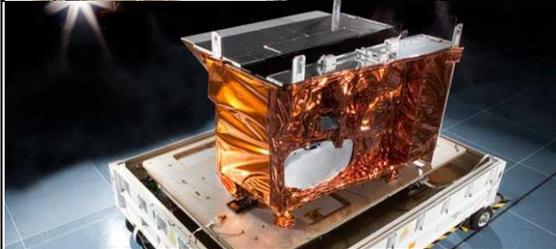


The Camp Fire captured by NOAA-20's VIIRS instrument on November 8, 2018

JPSS/PFO Program Scope	JPSS Program: 3 Satellites (Suomi NPP, JPSS-1, JPSS-2) PFO: 2 Satellites (PFO/JPSS-3, PFO/JPSS-4)
Operational Design Life	Suomi NPP – 5 years; JPSS/PFO – 7 years
JPSS-1 (now NOAA-20) Launch Date	November 18, 2017
JPSS-2 Launch Commitment Date	JPSS-2: Q1 FY 2023
PFO Launch Commitment Dates	JPSS-3: Q4 FY 2026 (planned); JPSS-4: Q4 FY 2031 (planned)
Program Operational Life	JPSS: FY 2012 - FY 2025; PFO extends to 2038
JPSS Program Life Cycle Cost	JPSS: \$11.322 billion; PFO: \$7.6 billion (est)

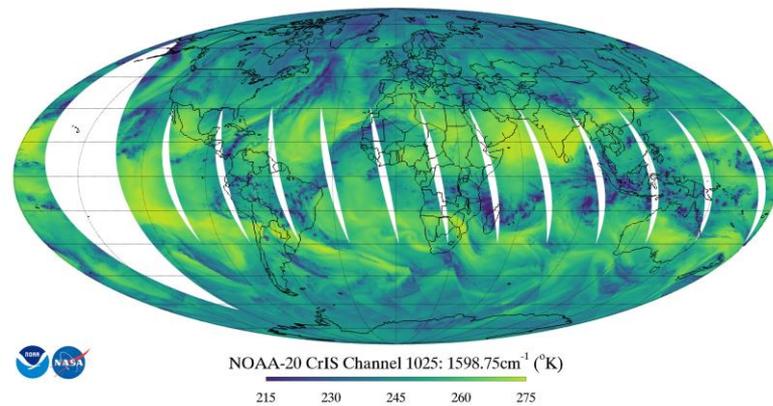
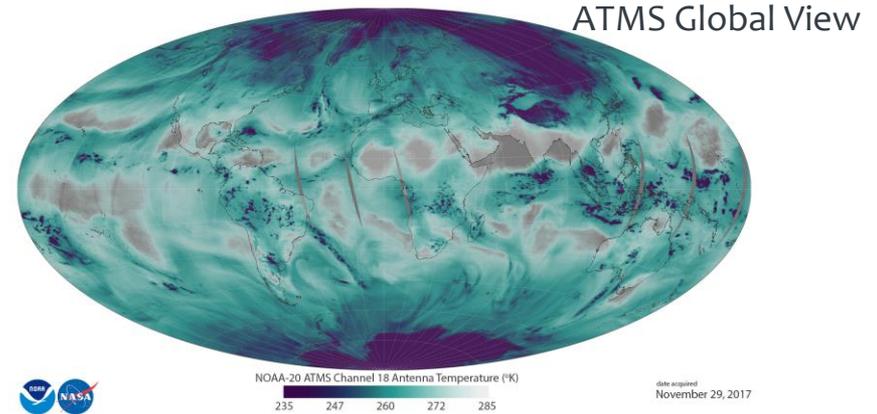
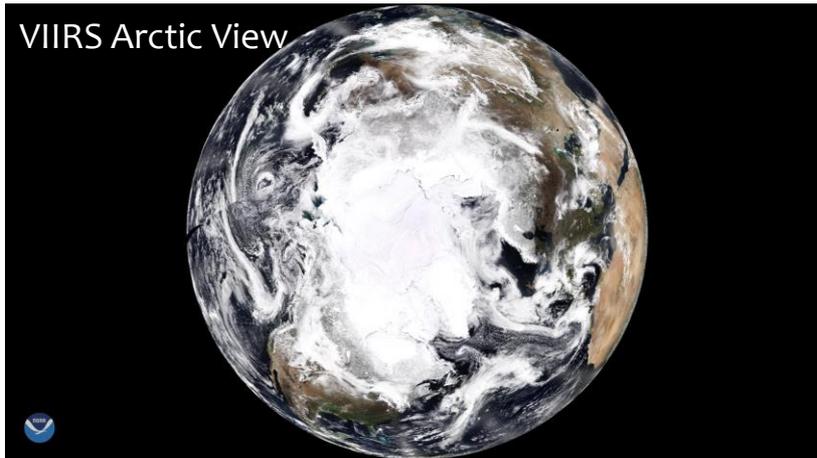
JPSS Series Instruments



JPSS/PFO Instruments		Measurements	Manufacturer
 <p>ATMS</p> <p>CrIS</p>	<p>Advanced Technology Microwave Sounder (ATMS)</p> <p>Cross-track Infrared Sounder (CrIS)</p>	<p>ATMS and CrIS work in tandem to collect water vapor and temperature of Earth's entire atmosphere. Data collected helps maintain and improve forecasts up to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks</p>	<p>Northrop Grumman Corporation (ATMS)</p> <p>Harris Corporation (CrIS)</p>
	<p>Visible Infrared Imaging Radiometer Suite (VIIRS)</p>	<p>VIIRS data is used to measure cloud and aerosol properties, ocean color, sea and land surface temperature, ice motion and temperature, fires, and Earth's albedo.</p>	<p>Raytheon Company</p>
	<p>Ozone Mapping and Profiler Suite (OMPS)</p>	<p>OMPS tracks the health of the ozone layer and measures the concentration of ozone in the Earth's atmosphere. OMPS consists of three spectrometers: a downward-looking nadir mapper, nadir profiler and limb profiler. The entire OMPS suite, OMPS-Nadir (OMPS-N) and OMPS-Limb (OMPS-L), currently fly on board the Suomi NPP spacecraft and are scheduled to fly on the JPSS-2, -3, and -4 satellite missions. OMPS-N is on the JPSS-1 satellite mission.</p>	<p>Ball Aerospace & Technologies Corporation</p>
	<p>Clouds and the Earth's Radiant Energy System (CERES)*</p>	<p>CERES is a three-channel radiometer that measures both solar-reflected and Earth-emitted radiation from the top of the atmosphere to the surface.</p> <p>* CERES will not be on JPSS-2 and future satellites.</p>	<p>Northrop Grumman Corporation</p>



NOAA-20 Delivering Astounding Data



CrIS Global View

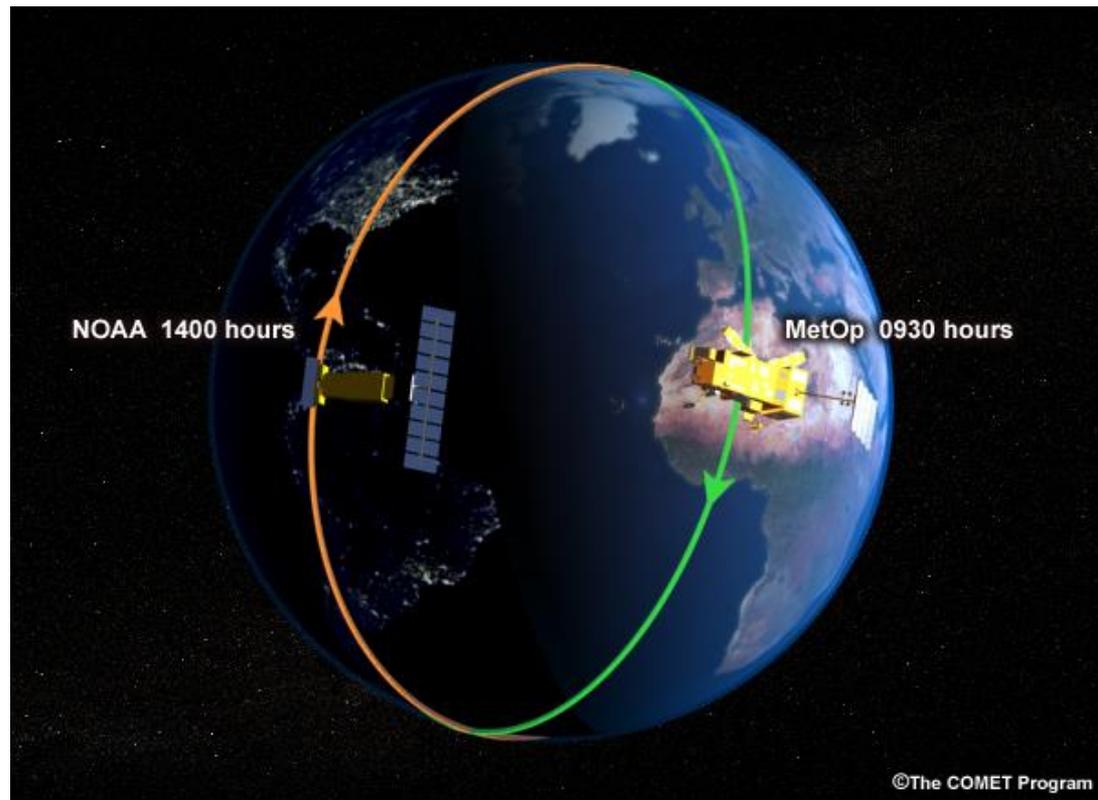




International Partnership Example: Metop-C



- EUMETSAT launched Metop-C, a new polar-orbiting satellite, on November 6, 2018
- Metop satellites monitor the “mid-morning” orbit, while NOAA’s polar-orbiting satellites, NOAA-20 and Suomi NPP, provide observations in the “mid-afternoon” orbit
- NOAA supplied 4 of the 13 instruments on Metop-C
- NOAA is still receiving data from Metop-A and Metop-B, launched in 2006 and 2012 respectively. These satellites, including Metop-C, are flying POES era instruments.
- **NOAA JPSS and Metop each provide ~50% of the data that goes into our Numerical Weather Prediction models**



NOAA and EUMETSAT polar-orbiting satellites pass over the same location at different times of day. (Credit: UCAR/COMET Program)

Overview: Geostationary Operational Environmental Satellites



NOAA currently operates two generations of GOES satellites that monitor the Western Hemisphere

1. GOES-R series (4 satellites)
 - a. GOES-16 (previously GOES-R) is operational as NOAA's GOES East
 - i. Primary weather satellite covering the eastern U.S., the Atlantic, and part of Africa
 - b. GOES-17 (previously GOES-S) will become operational as GOES West in January 2019
 - i. Positioned to watch over the western US, Alaska, Hawaii, Mexico, Central America, parts of South America, and the Pacific Ocean
2. GOES-N Series (3 satellites)
 - a. GOES-15, the current GOES West satellite, will monitor the Earth from 128 degrees west, as the on-orbit spare.
 - b. GOES-14 is the current on-orbit spare
 - c. GOES-13 recently retired as GOES East



Hurricane Michael taken from GOES East Advanced Baseline Imager (ABI)

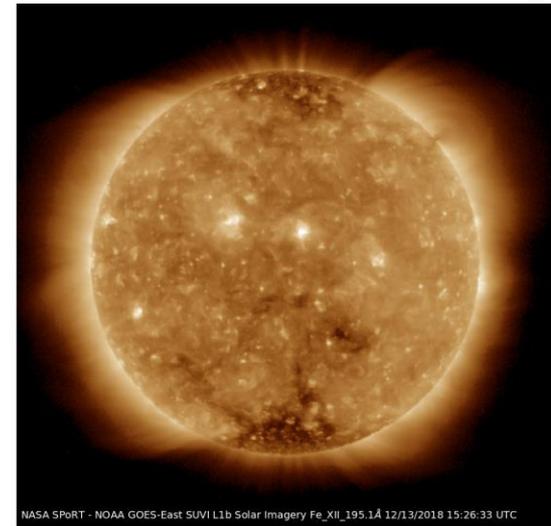
GOES-R Series Program Scope	4 Satellites (GOES-R, S, T & U)
Operational Design Life	10 years for each spacecraft
GOES-R Launch Date	November 19, 2016
GOES-S Launch Date	March 1, 2018
GOES-T and -U Launch Commitment Dates	GOES-T: Q4 FY 2020; GOES-U: Q1 FY 2025
Program Operational Life	FY 2017 – FY 2036
Program Life Cycle Cost	\$10.828 billion

GOES-R Series Mission and Data Collection

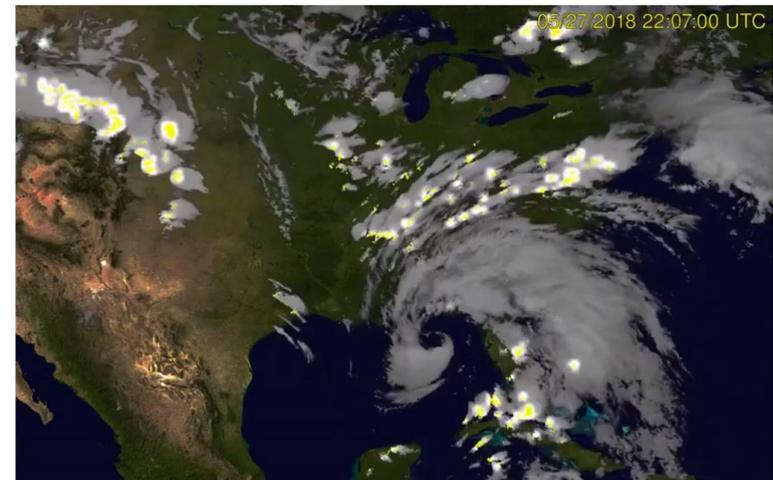


NOAA's GOES-R Series provides advanced imagery and atmospheric measurements of Earth's Western Hemisphere, real-time mapping of lightning activity, and improved monitoring of solar activity and space weather

- Scans the Earth five times faster with four times the resolution and three times the number of channels than previous GOES
 - Provides images of weather patterns, hurricanes and severe storms as frequently as every 30 seconds
- Critical for:
 - Input to weather models, forecasts, and warnings
 - Sea surface temperature monitoring for fisheries and climate use
 - Winds for aviation use and space weather
 - Solar imagery for communications satellites, utility companies, and astronaut safety
 - Communications hub for buoy and stream gauge, and other environmental data collection
 - Satellite-aided search and rescue



GOES EAST SUVI solar image
December 2018



GOES-16 Geostationary Lightning Mapper - Hurricane Alberto
May 2018

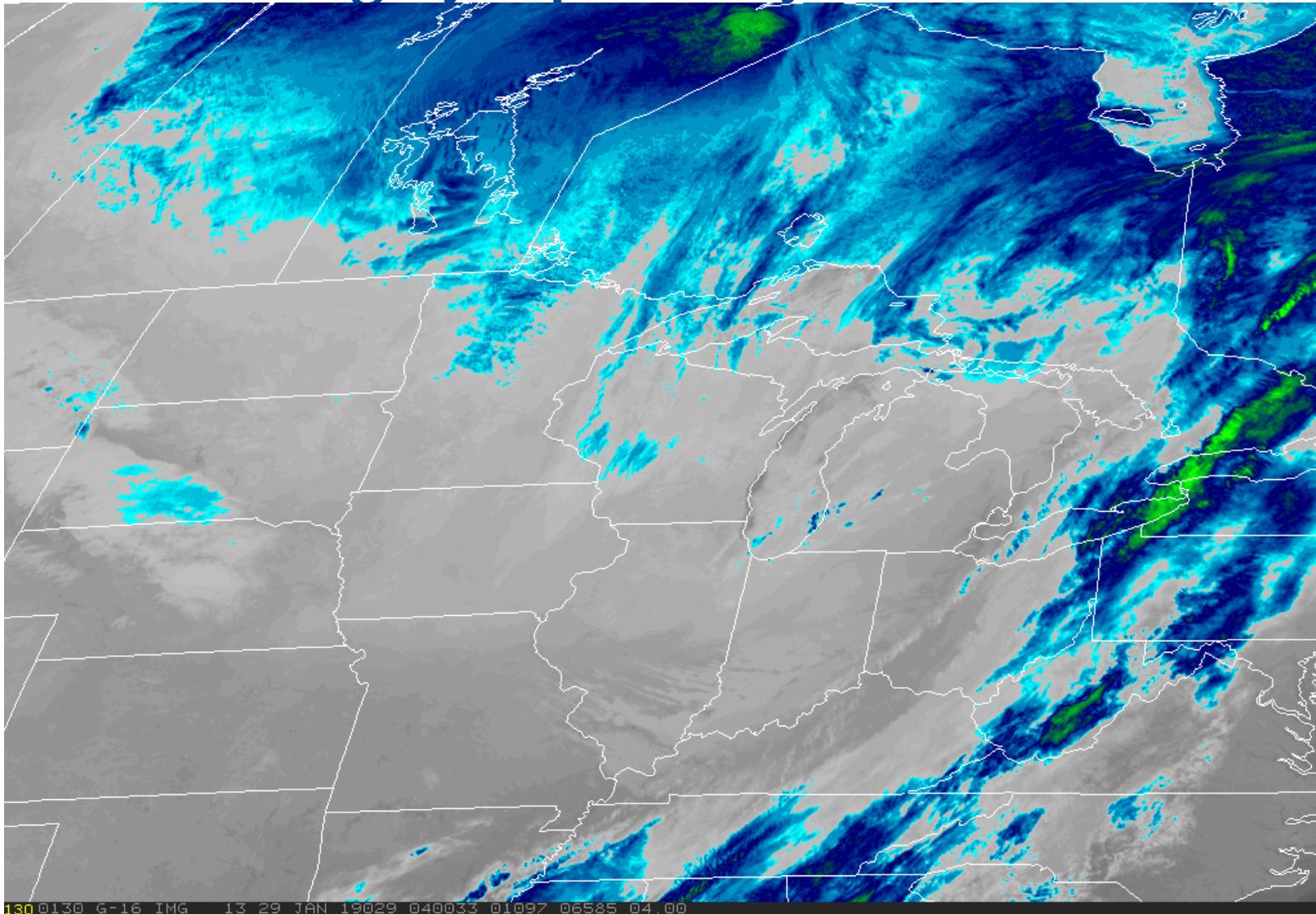


GOES-R Series Instruments

Instruments	Measurements	Manufacturer
	<p>Advanced Baseline Imager (ABI)</p> <p>ABI is the primary instrument for imaging Earth's weather, climate, oceans and the environment. ABI views the Earth with 16 spectral bands (compared to 5 on previous GOES)</p>	<p>Harris Corporation</p>
	<p>Geostationary Lightning Mapper (GLM)</p> <p>GLM is the first-ever operational lightning mapper flown in geostationary orbit. The instrument measures total lightning (in-cloud and cloud-to-ground) activity.</p>	<p>Lockheed Martin Advanced Technology Center</p>
	<p>Extreme Ultraviolet and X-Ray Irradiance Sensors (EXIS)</p> <p>EXIS detects and monitors solar irradiance in the upper atmosphere. The X-Ray Sensor monitors solar flares that can disrupt communications and degrade navigational accuracy, affecting satellites, astronauts, high-latitude airline passengers and power grid performance.</p>	<p>Laboratory for Atmospheric and Space Physics</p>
	<p>Solar Ultraviolet Imager (SUVI)</p> <p>SUVI is a telescope that observes and characterizes coronal holes, solar flares and coronal mass ejection source regions.</p>	<p>Lockheed Martin Advanced Technology Center</p>
	<p>Magnetometer (MAG)</p> <p>The MAG provides measurements of the space environment magnetic field that controls charged particle dynamics in the outer region of the magnetosphere. These particles can be dangerous to spacecraft and human spaceflight.</p>	<p>Lockheed Martin Advanced Technology Center</p>
	<p>Space Environment In-Situ Suite (SEISS)</p> <p>SEISS is an array of sensors that monitor proton, electron and heavy ion fluxes at geosynchronous orbit. Information provided by SEISS is used for assessing radiation hazards to astronauts and satellites and to warn of high flux events, mitigating damage to radio communications.</p>	<p>Assurance Technology Corporation</p>



Arctic Air Mass Sweeps Through Midwest – Infrared Imagery Captured by GOES East



Space Weather Observing System Requires Research & Operational Partnerships





Radio Occultation Data Acquisition

NOAA's plan to meet its radio occultation (RO) data requirements involves actively working with other agencies, the international community, and the commercial sector to source data sets needed to meet the National Weather Service numerical weather prediction (NWP) modelling requirements. NOAA is also assessing the feasibility of RO payloads as part of future NOAA satellite constellations

- Continue to leverage data from U.S. and international partners from current missions (now through end of mission)
 - Taiwan COSMIC-1
 - EUMETSAT Metop-A and Metop-B
 - NASA GRACE-B
 - German TerraSAR-X
 - Korea KOMPSAT-5
 - Spain PAZ
 - U.S.-German GRACE-Follow on
 - EUMETSAT Metop-C
- Through the **Commercial Weather Data Pilot (CWDP)** work with U.S. commercial sector to acquire data to determine its suitability for operational use, and purchase it for operations as commercial capability matures
- Leverage data from U.S. and international partners from future missions
 - 2019- Taiwan-U.S. COSMIC-2 (equatorial only)
 - 2020- EUMETSAT Metop Second Generation
 - 2020 - U.S.-EUMETSAT Jason CS
- Explore placing RO sensors on future NOAA and international partner polar-orbiting satellites (2022 through 2036)



EUMETSAT



DLR



European Space Agency



NSPO



KARI
KOREA AEROSPACE RESEARCH INSTITUTE





Office of Satellite and Product Operations

Satellite Operations

- NOAA Satellite Operations Facility (NSOF), located in Suitland, Maryland, is the control center for all NOAA and DMSP satellite operations
- Provides critical near real-time data to the U.S. and international partners
- 24-hour mission control for search and rescue satellite-aided tracking (SARSAT) program
- NESDIS also has command and data acquisition facilities in Wallops, VA, Fairmont, WV, and Fairbanks, AK, and Utqiagvik, AK
- OSPO is supported by non-NOAA, shared ground installations Svalbard, Norway and McMurdo in Antarctica



NSOF Building, Suitland, MD

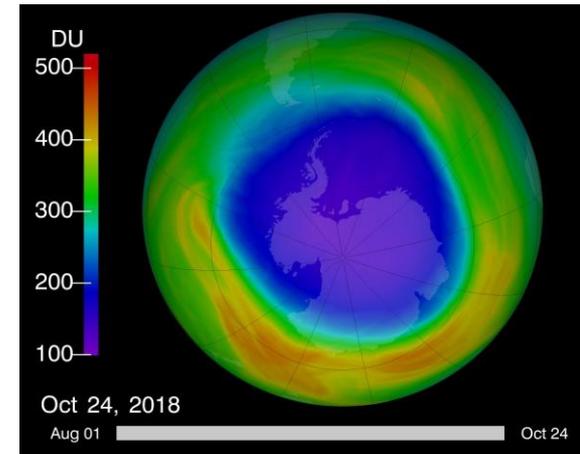
Satellite Data Processing and Distribution

Near Real Time Products

- Atmospheric sounders (e.g., total perceptible water, snowfall rate, temperature)
- Geostationary imagery (e.g., tropical cyclone products)
- Hazard products (e.g., fire and smoke, volcanic ash)

Lower-latency Products

- Surface, Hydrology, and Vegetation Products
- Ocean Products (Sea Surface Height)
- Ice Products (as part of the Navy-Coast Guard-NOAA National Ice Center)



Total Ozone over the Antarctic Pole. Purple and blue represent less ozone than green and yellow



Satellite Ground Services

NESDIS' Office of Satellite Ground Systems (OSGS) has three main missions:

- 1) **Sustain** - NESDIS legacy ground systems and develop early enterprise elements
- 2) **Enable** - Transition and sustain next generation ground segments for JPSS and GOES-R
- 3) **Create** - Develop and deploy common Ground Enterprise Architecture Services

Through capability enhancements and technology refreshes, OSGS extends the life cycle and utility of NOAA satellite ground systems, such as those for GOES and JPSS.

OSGS is also responsible for managing risk to ground systems to assure high-performance operations, reliable data, and readily available data for NOAA customers.

Select OSGS initiatives and systems :

- Ground system antennas
 - All data collected by satellite missions pass through these antennas -a quintessential element of the NESDIS infrastructure
- Comprehensive Large Array-data Stewardship System (CLASS)
 - Online facility for the distribution of data products and derived data from NOAA's satellite systems

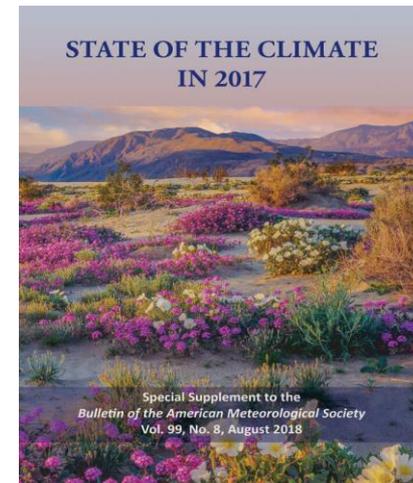


National Centers for Environmental Information (NCEI)

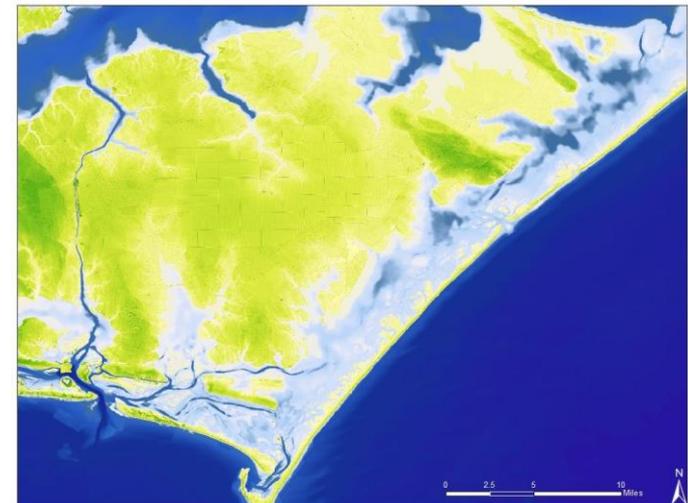


NCEI hosts and provides access to one of the most significant archives on earth, with comprehensive oceanic, atmospheric, and geophysical data.

- Acquires and archives environmental data from U.S. and foreign sources
 - Satellite, land, air, and ocean-based observations
- Preserves over 25 petabytes of environmental data for private industry and businesses, local to international governments, academia, as well as the general public uses.
- Supports 4 of 16 Cooperative Institutes (CI)
 - CI's consist of more than 40 universities and research institutions across 23 states and Washington D.C
- Published U.S. 2017 Billion-Dollar Weather and Climate Disasters report. U.S. 2018 report will be released in February 2019.
- Completed Digital Elevation Models (DEMs), which is a critical tool used for hurricane season, for Miami, FL and NC Barrier Islands
- NCEI scientists were the lead editors of the Bulletin of the American Meteorological Society's "State of the Climate in 2017" Report



NCEI served as lead editors in *Bulletin of the American Meteorological Society* "State of the Climate in 2017" Report



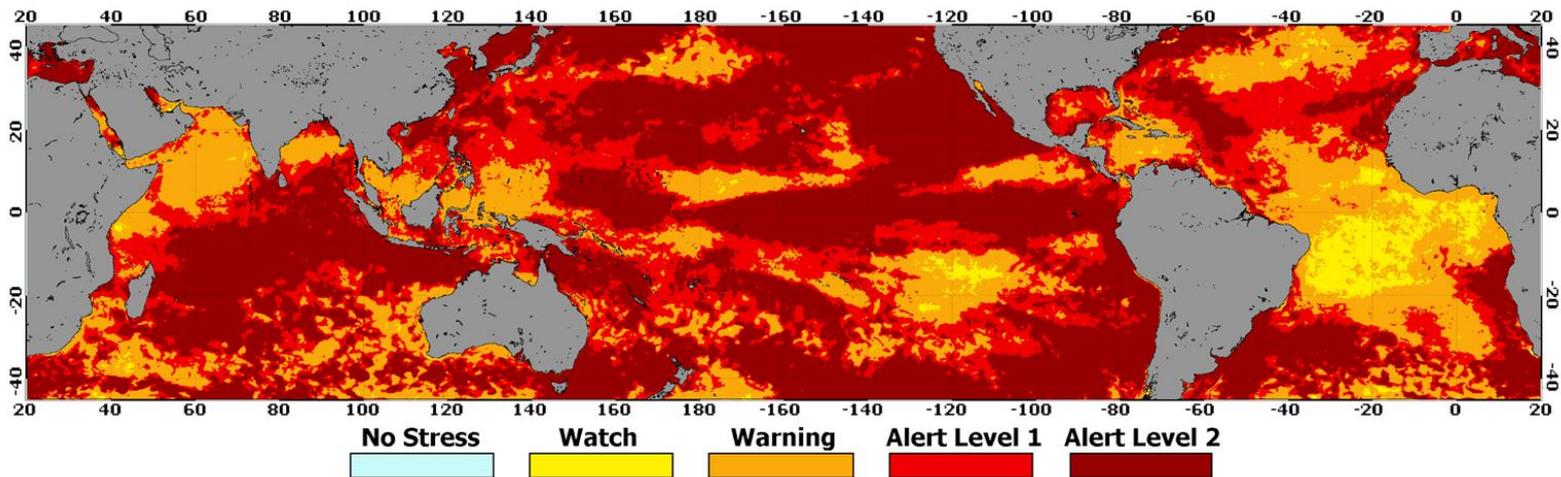
Integrated topographic-bathymetric digital elevation model of eastern North Carolina (Morehead City/Beaufort and vicinity)

Center for Satellite Applications and Research (STAR)



- Leads NESDIS research, development, validation, and maintenance of satellite-derived products and applications based on end user needs
- Supports the development of NOAA satellite sensors and missions through their life cycle
 - Develop instrument performance requirements
 - Evaluate performance and address anomalies during development
 - Perform pre- and post-launch calibration and validation of data
- Collaborates with researchers at Cooperative Institutes (CIs) across the country
- Collaborates with partners to make external sources satellite of data suitable for NOAA missions and establish international standards for interoperability among providers and users

NOAA Coral Reef Watch 5 km Maximum Satellite Coral Bleaching Alert Area June 2014 - May 2017



Maximum bleaching-level heat stress experienced by corals worldwide during the third global coral bleaching event. More than 75% of reefs experienced high heat stress during this three-year event



Other Programs and Initiatives

Cooperative Data and Rescue Services (CDARS)

- Supports space-based components of Argos Advanced Data Collection System (Argos A-DCS)
- Supports the Search and Rescue Satellite Aided Tracking (SARSAT) program

Office of Space Commerce (OSC) and Commercial Regulatory Affairs (CRSRA)

- OSC: Advocates for commercial space industry
- CRSRA: Regulatory authority and enforcement of commercial satellites with ability to view Earth Both of these offices play an important role for the larger space industry.
 - Actively working on updating CRSRA regulations
 - The Secretary of Commerce has proposed to transfer these offices from NOAA to the Department in an effort to meet the Administration's desire to prioritize management of the space industry.

Commercial Weather Data Pilot

- Demonstrates the viability of integrating commercial data into the NOAA operations data stream
- Enables the commercial sector to establish and sustain capabilities to meet NOAA's ongoing operational needs.

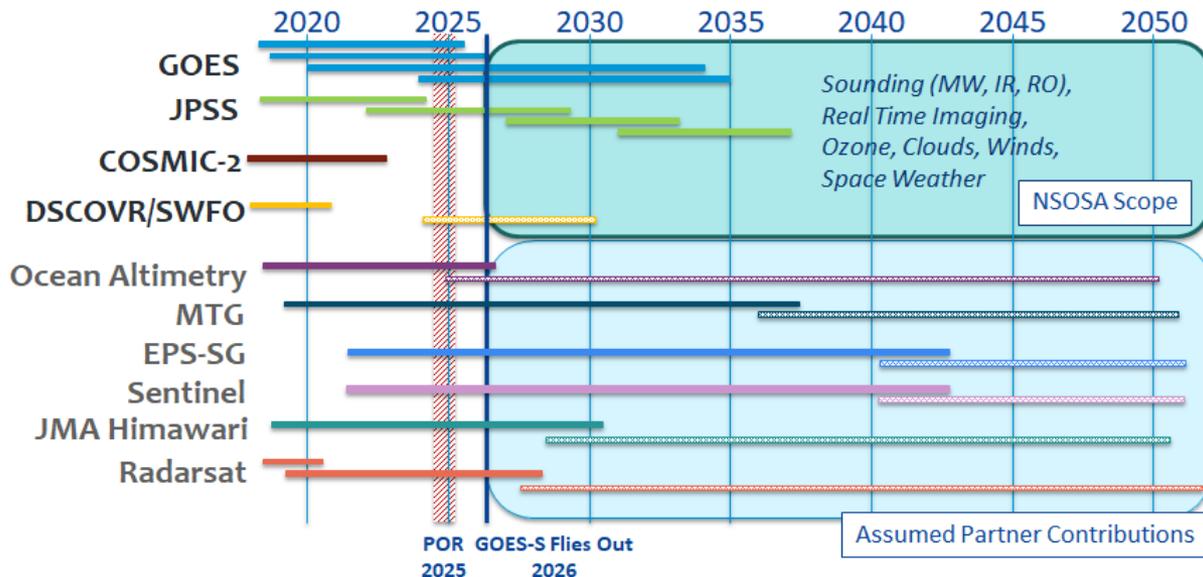
Jason -2 & -3 Satellites

- Launched in June 2008 and January 2016, respectively
- Partnership between EUMETSAT and the French Space Agency (CNES), and NOAA
- Maintain satellite altimetry observations of global sea surface height.



Looking Ahead: Post- JPSS and GOES-R

- Evolving to a more mission-effective, integrated, adaptable, and affordable portfolio
 - Responding to changing technology, emerging partnerships and evolving observation requirements
 - Explore implementation of new authorities in the Weather Research and Forecasting Innovation Act (reauthorized January 2019).
- Why start now?
 - 10-15+ year development timeline for space assets
 - Current constellation (GOES-R/S/T/U and JPSS-1/2/3/4) fly-outs 2026-2035
- The NOAA Satellite Observing Systems Architecture (NSOSA) study is examining NOAA’s future space segment architecture decisions, defining NOAA space investments makes to deploy satellite observations in the 2030-2050 epoch



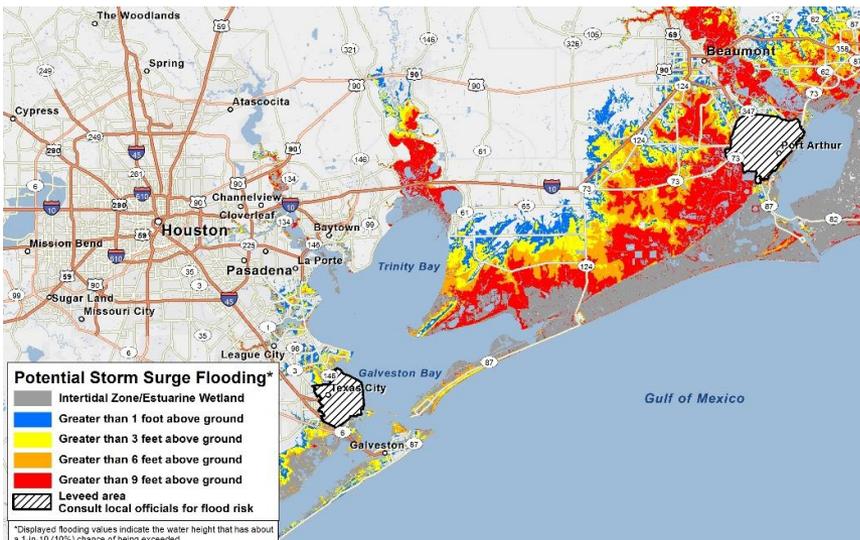
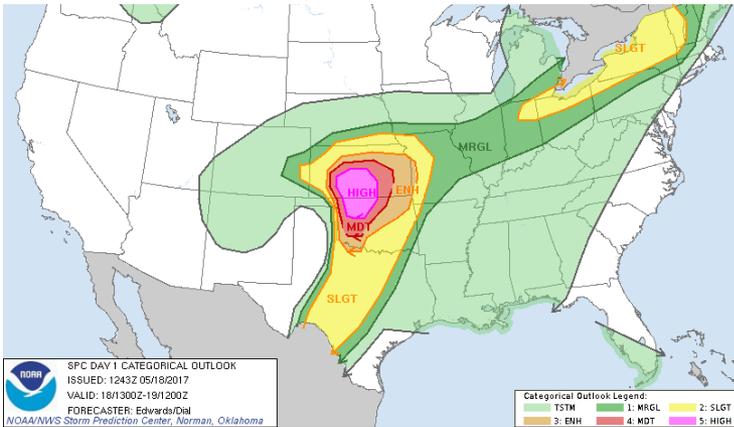


NOAA Satellite Observing Systems Architecture (NSOSA) Study

Examining the space segment architecture decisions for space systems post GOES-R/S/T/U and JPSS-1/2/3/4.

NSOSA:

- Address NOAA's systems with a knowledge and inclusion of partner contributions and relationships
- Address NOAA Operational Needs
- Seeks which observation functions should be allocated to which orbit?
- Studies legacy architecture to keep legacy or seek change
- Studies observation functions to find needed improvements





Commercial Partnerships

In an effort to align with the Administration's commercial space expansion, NESDIS has released a number of Requests for Information (RFI) and Requests for Proposals (RFP). NESDIS has also recently awarded contracts to support delivery of NOAA's critical mission to the Nation:

- **July 31:** Released an RFI for JPSS-2 rideshare. Closed on August 30.
- **August 9:** Released an RFI for expressions of interest in collaborative R&D on innovative approaches for exploiting environmental data. Closed on September 24.
- **September 17:** Awarded contracts to GeoOptics, PlanetIQ, and Spire Global as part of the Commercial Weather Data Pilot (CWDP) Round 2.
- **September 27:** Awarded a contract to Thales USA, Inc. to design, build, install, and check out a Medium Earth Orbiting Local User Terminal (MEOLUT) ground station in New Mexico.
- **November 7:** Awarded a contract to the Hosted Payload Solutions mission delivery order to General Atomics of Englewood, Colorado. This contract will support launch of the Argos A-DCS instrument as a hosted payload to low Earth orbit on a commercial spacecraft by late 2021.



Recent Accomplishments



In 2018

- NOAA-20 became operational
- We launched GOES-17 and saw the first images from the satellite's new vantage point over the Pacific
- We provided 4 instruments for EUMETSAT's Metop-C satellite
- We tracked 15 named storms -- including 8 Atlantic hurricanes
- We observed the eruption of Hawaii's Kilauea volcano
- We monitored storms using GOES East's Geostationary Lightning Mapper
- We tracked smoke from California's deadly wildfires



Mapping Lightning



Observing California Wildfires



Observing Hawaii's Volcanic Eruptions



Tracking Hurricane Florence and Michael



Synergies across NOAA

Our satellites produce more than just incredible images. NESDIS's satellites provide reliable data used to track wildlife, forecast the weather, monitor the daily global chlorophyll concentration, and create digital elevation models that are used to show the potential impact of storm surges and sea level rise.

